US Army Corps
of Engineers
Alaska District

Final Environmental Impact Statement

Alaska Stand Alone Gas Pipeline

October 2012

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In cooperation with:

Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)

U.S. Coast Guard (USGS)

U.S. Department of the Interior, Bureau of Land Management (BLM)

U.S. Department of the Interior, National Park Service (NPS)

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (USDOT, PHMSA)

U.S. Environmental Protection Agency (EPA)

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Final Environmental Impact Statement
ASAP EIS

Lead Agency:	Department of the Army U.S. Army Engineer District, Alaska Post Office Box 6898 JBER, Alaska 99506-0898
Cooperating Agencies:	U.S. Environmental Protection Agency Alaska Operations Office 222 West 7th Ave., Box 19 Anchorage, Alaska 99513-7588
	U.S. Bureau of Land Management 222 West 7th Avenue, #13 Anchorage, Alaska 99501
	U.S. National Park Service 240 West 5th Avenue, Suite 114 Anchorage, Alaska 99501
	Alaska Department of Natural Resources State Pipeline Coordinators Office 411 West 4th Avenue, 2nd Floor Anchorage, Alaska 99501
	U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration East Building, 2nd Floor 1200 New Jersey Ave., SE Washington, District of Columbia 20590
	U.S. Coast Guard P.O. Box 25517 Juneau, Alaska 99802
Project Location:	From Prudhoe Bay to Southcentral Alaska
For further information contact:	Mary Romero United States Army Corps of Engineers Alaska District, Regulatory Division CEPOA-RD Post Office Box 6898 JBER, AK 99506-0898 907.753.2773 mary.r.romero@usace.army.mil

Final EIS Filed with EPA: October 19, 2012

Comments: The official comment period for the Draft EIS was held from January 20, 2012 until April 4, 2012. The Record of Decision (ROD) for this Final EIS will be issued no earlier than November 26, 2012, but can only be completed after a complete application is received and the Public Review process has been completed.

The U.S. Army Corps of Engineers, Alaska District, Regulatory Division (Corps) received a request from the State of Alaska (currently AGDC is the proponent) to complete a Environmental Impact Statement (EIS) and a notice of intent was published in the Federal Register December 4, 2009. In compliance with the National Environmental Policy Act (NEPA) and in conjunction with the cooperating agencies a Draft EIS was developed and released in January 2012.

Abstract: On November 1, 2011, the USACE, Alaska District received the Alaska Gasline Development Corporation's (the Applicant's) draft permit application to construct and operate the proposed Alaska Stand Alone Gas Pipeline Project (Project). The applicant is gathering the information necessary for a complete application. The proposed Project includes the construction of structures in navigable waters of the United States (U.S.) and the discharge of dredged and/or fill materials into waters of the U.S., including wetlands. The proposed work requires authorization from the USACE under Section 10 of the Rivers and Harbors Act (RHA) of 1899 and Section 404 of the Clean Water Act (CWA). The Final Environmental Impact Statement (EIS) will be used to evaluate the Applicant's USACE permit application and compliance with the National Environmental Policy Act (NEPA).

The USACE and the cooperating agencies have prepared this Final EIS (FEIS), which identifies and evaluates the potential direct, indirect and cumulative environmental impacts associated with the proposed action and alternatives, including the No Action Alternative. Applicant proposed measures to mitigate adverse impacts are described and evaluated. The FEIS has been prepared to address issues and alternatives raised during the scoping process and all public comments received on the January 2012 Draft EIS (DEIS). A summary of the DEIS public meetings and written comment letters, and response to comments is incorporated into the FEIS. The FEIS will be used in conjunction with a complete USACE permit application to develop a Record of Decision.

This Final EIS incorporates changes based on over 1200 individual comments received and considered by the Corps. The Corps held 12 public meetings during the Draft EIS review period and also held separate meetings with government agencies with regulatory jurisdiction over land, development, or with a permitting nexus. The Corps also held teleconferences with Alaska Native Tribes along the area of impacts of the proposed project.

Based on comments received, errors in the Draft EIS were corrected and sections edited for clarity and accuracy. The Final EIS is the result of these changes. Overall impact findings did not change between the Draft and Final EIS's, although descriptions have been modified for clarity.

The Final EIS analyzes potential impacts to the human and the natural environments that could result from the proposed project and the alternatives considered. All action alternatives were compared to the environmental impacts associated with the no action alternative, which would not meet the annual demands for natural gas within the Fairbanks, Anchorage and Cook Inlet areas. Neither would the benefits of the project be realized including a reliable long term natural gas supply for Fairbanks and Southcentral Alaska; improved air quality for the Fairbanks area; revenues to the State of Alaska from gas sales, taxes, and royalties; and jobs related to construction and operation of the proposed project.

The EIS also presents the Applicant's proposed mitigation to avoid or minimized impacts from the proposed project. These mitigation measures have been included in the analysis of impacts. The Corps would also consider additional mitigative measures, including those proposed by the public and agencies during the permitting process to avoid, minimize, rectify, reduce or compensate for potential impacts to the environment.

After release of this Final EIS the Corps will finalize its decision to issue or deny a permit. The Corps' decision will be documented in a Record of Decision and be based on information contained in the Final EIS, along with the review of information provided in a complete application in compliance of the Clean Water Action Section 404(b)(1) Guidelines, a Public Interest Review, and other applicable laws and regulations.

Responsible Official for FEIS:

Christopher D. Lestochi
Colonel, Corps of Engineers
District Commander

Helpful Notes for Reading the Final Environmental Impact Statement (FEIS)

The following notes are intended to help readers gain an overall perspective of the FEIS and the information it contains. For those readers interested in specific sections of the FEIS, these guidelines will help determine where to find the information you want to review. However, it is important to note that each section builds on the one before it.

Following Federal regulations, this FEIS was designed and written for two main purposes: (1) to provide the U.S. Army Corps of Engineers (USACE) and six cooperating agencies (listed below) with sufficient information to make informed, reasoned decisions concerning the proposed Alaska Gasline Development Corporation's (AGDC) Alaska Stand Alone Gas Pipeline/ASAP Project; and (2) to inform members of affected communities and interested public of this project so that they may express their opinions to the USACE.

Cooperating Agencies:
Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)
U.S. Coast Guard (USCG)
U.S. Department of the Interior, Bureau of Land Management (BLM)
U.S. Department of the Interior, National Park Service (NPS)
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (USDOT, PHMSA)
U.S. Environmental Protection Agency (EPA)

This FEIS consists of the following sections:

Executive Summary
1.0 Purpose and Need
2.0 Project Description
3.0 Connected Actions
4.0 Alternatives
5.0 Environmental Analysis
- 5.1 Soils and Geology
- 5.2 Water Resources
- 5.3 Terrestrial Vegetation
- 5.4 Wetlands
- 5.5 Wildlife
- 5.6 Fisheries
- 5.7 Marine Mammals
- 5.8 Threatened and Endangered Species
- 5.9 Land Use
- 5.10 Recreation
- 5.11 Visual Resources
- 5.12 Socioeconomics
- 5.13 Cultural Resources
- 5.14 Subsistence
- 5.15 Public Health
- 5.16 Air Quality
- 5.17 Noise
- 5.18 Navigation Resources
- 5.19 Reliability and Safety

5.20 Cumulative Effects
5.21 Short-term Use Versus Long-term Productivity of the Environment
5.22 Irreversible and Irretrievable Commitment of Resources
5.23 Mitigation Measures
6.0 Conclusions

References utilized as information sources for development of the EIS are listed at the end of each section (and major subsection under the Environmental Analysis).

A **glossary** with key terms and acronyms is included after the table of contents.

The **Executive Summary** presents an overall description of the proposed action, its purpose and need, and environmental consequences. The purpose of this section is to provide non-technical readers an understanding of the potential environmental, technical, economic, and social consequences of **taking** and of **not taking** action.

Section 1 describes the purpose and need of the ASAP Project. It provides a very brief description of the ASAP Project and then explains four key things about the project: (1) the project purpose and need, (2) the relevant environmental issues, (3) the decisions that the USACE and other federal agencies must make concerning this project, and (4) the relevant laws, regulations, and consultation with which AGDC must comply.

Section 2 provides a detailed description of the applicant's proposed project (the proposed action).

Section 3 provides a description and analysis of connected actions – other related projects not proposed by the applicant that would need to be undertaken for the proposed projected to be operated as planned and stated in Section 2.

Section 4 describes potential alternatives to the proposed action and presents a screening level analysis to identify reasonable alternatives for further detailed analysis and comparison in Section 5.

Section 5 briefly describes the past and current conditions of the relevant resources *(issues)* in the project area that would be measurably affected, establishing a part of the baseline used for the comparison of the predicted effects of all alternatives. Detailed, analytic predictions of the consequences of implementing the proposed action and alternatives are also presented. These predictions include the direct, indirect, short term, long term, irreversible, irretrievable, and cumulative effects of implementing the alternatives.

Section 6 provides a summary of resource impacts for the proposed action and alternatives. A comparative analysis of impacts is also included to assist readers and decision makers in identifying their preferred alternative.

An alphabetical **subject index** is included at the end of the FEIS.

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

LIST OF APPENDICES

Table of Contents (Continued)

List of Tables

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Tables (Continued)

Table of Contents (Continued)

List of Figures

Table of Contents (Continued)

List of Figures (Continued)

Table of Contents (Continued)

List of Figures (Continued)

Table of Contents (Continued)

List of Figures (Continued)

Table of Contents (Continued)

List of Figures (Continued)

Table of Contents (Continued)

List of Figures (Continued)

Glossary, Acronyms, and Abbreviations

AAC	The abbreviation for Alaska Administrative Code.
AAQS	The abbreviation for Ambient Air Quality Standards.
ABVS	The abbreviation for Alaska Bureau of Vital Statistics.
ACEC	The abbreviation for Area of Critical Environmental Concern.
ACMP	The abbreviation for Alaska Coastal Management Program.
acoustics	Is the interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound.
ACS	The abbreviation for American Community Survey.
ACW	The abbreviation for Aircraft Control and Warning.
ADEC	The abbreviation for Alaska Department of Environmental Conservation.
ADF&G	The abbreviation for Alaska Department of Fish and Game.
ADHSS	The abbreviation for Alaska Department of Health and Social Services.
ADNR	The abbreviation for Alaska Department of Natural Resources.
adverse effect	The impairment of, or damage to, the environment or health of humans, or damage to property, or loss of reasonable enjoyment of life or property.
AEA	The abbreviation for Alaska Energy Authority.
AES	The abbreviation for Arctic Slope Regional Corporation Energy Services.
AFN	The abbreviation for Alaska Federation of Natives.
AFS	The abbreviation for Air Force Station.
AGDC	The abbreviation for the Alaska Gasline Development Corporation.
aggradation	The increase in land elevation due to the deposition of sediment.
AGIA	The abbreviation for Alaska Gasoline Inducement Act.
AHRS	The abbreviation for Alaska Heritage Resource Survey.
AIAN	The abbreviation for American Indian or Alaska Native.

Glossary, Acronyms and Abbreviations (Continued)

AKDPS	The abbreviation for Alaska Department of Public Safety.
alluvial	Pertaining to, or consisting of, alluvium, or material deposited by flowing water.
alluvial fan	Is a fan-shaped deposit formed where a fast flowing stream flattens, slows, and spreads typically at the exit of a canyon onto a flatter plain.
alluvium	Is loose, unconsolidated soil or sediments, which is then eroded, deposited, and reshaped by water in some form in a non-marine setting.
ARM	The abbreviation for additional recommended mitigation.
AMHS	The abbreviation for Alaska Marine Highway System.
amphidromous	Fish species that spend the summer feeding at sea, and move to freshwater rivers and streams in late summer and fall to spawn and live for the winter.
AMS	The abbreviation for American Meteorological Society.
anadromous	Fish that migrate from salt water to fresh water to spawn and die.
ANCSA	The abbreviation for Alaska Native Claims Settlement Act.
ANGTS	The abbreviation for Alaska Natural Gas Transportation System.
ANHP	The abbreviation for Alaska Natural Heritage Program.
ANILCA	The abbreviation for Alaska National Interest Lands Conservation Act.
anode	An electrode through which electric current flows into a polarized electrical device.
anthropogenic	Materials made or modified by humans.
ANWR	The abbreviation for Arctic National Wildlife Refuge.
APA	The abbreviation for Alaska Power Authority.
APDES	The abbreviation for Alaska Pollutant Discharge Elimination System.
APE	The abbreviation for the Area of Potential Effect.
APP	The abbreviation for Alaska Pipeline Project.
aquatic	Living in or near water or taking place in water.
ARC	The abbreviation for Alaska Regulatory Commission.
Archaic period	Was the second period of human occupation in the Americas, from around 8000 to 2000 BC.

Glossary, Acronyms and Abbreviations (Continued)

ARCO	The abbreviation for Atlantic Richfield Company.
ARR	The abbreviation for the Alaska Railroad.
ARRC	The abbreviation for the Alaska Railroad Corporation.
artifact	Something made or given shape by man, such as a tool or a work of art.
AS	The abbreviation for Alaska Statutes.
ASAP	The abbreviation for the Alaska Stand Alone Gas Project.
ASTt	The abbreviation for Arctic Small Tool tradition.
ATDP	The abbreviation for Alaska Traditional Diet Project.
ATV	The abbreviation for all terrain vehicle.
BA	The abbreviation for Biological Assessment.
BACT	The abbreviation for Best Available Control Technology.
ballast	Water taken on ships and submarines and other submersibles to control buoyancy and stability.
BART	The abbreviation for Best Available Retrofit Technology.
baseline	Analysis of current situation to identify the starting points for a program or project.
bedrock	Solid rock that underlies soil or any other unconsolidated surficial cover.
benthic	The ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers.
BGEPA	The abbreviation for Bald and Golden Eagle Protection Act.
biodiversity	The degree of variation of life forms within a given ecosystem, biome, or an entire planet and is a measure of the health of ecosystems.
biota	The total collection of organisms of a geographic region or a time period.
Birnirk period	Represents a phase of prehistoric Eskimo culture dating back from 500 to 700 AD.
BLM	The abbreviation for Bureau of Land Management.
blowdown	The event of over pressurized pipeline becoming depressurized by venting gas to the atmosphere.

Glossary, Acronyms and Abbreviations (Continued)

BMPs	The abbreviation for best management practices.
BOEM	The abbreviation for Bureau of Ocean Energy Management.
borrow site	An area that is excavated to provide material, such as gravel or sand, to be used, where required, by the project.
BRFSS	The abbreviation for Behavioral Risk Factor Surveillance System.
broadband	Refers to any sound which has its energy spread over a number of frequencies.
BSEE	The abbreviation for Bureau of Safety and Environmental Enforcement.
BTU	The abbreviation for British Thermal Unit.
CA	The abbreviation for Census Area.
CAA	The abbreviation for Clean Air Act.
CAAA	The abbreviation for Clean Air Act Amendments.
CAM	The abbreviation for Compliance Assurance Monitoring.
carbon dating	A radiometric dating method that uses the naturally occurring radioisotope carbon-14 (^{14}C) to estimate the age of carbon-bearing materials up to about 58,000 to 62,000 years.
cathodic protection	A technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell.
CCP	The abbreviation for Comprehensive Conservation Plan.
CCS	The abbreviation for Carbon Capture and Sequestration.
CDP	The abbreviation for Census-Designated Place.
CEA	The abbreviation for Chugach Electric Association.
Central Gas Facility	An existing facility in Prudhoe Bay that receives natural gas from the surrounding oil and gas fields through gathering lines. The Central Gas Facility would send natural gas to the proposed GCF (Gas Conditioning Facility) at MP 0 before transport through the pipeline.
centrifugal compressors	Use a rotating disk or impeller in a shaped housing to force the gas to the rim of the impeller, increasing the velocity of the gas.
CERCLA	The abbreviation for Comprehensive Environmental Response Compensation and Liability Act.
CEQ	The abbreviation for Council on Environmental Quality.
CFR	The abbreviation for Code of Federal Regulations.

CGF	The abbreviation for Central Gas Facility.
CIRI	The abbreviation for Cook Inlet Region, Inc.
cirque	An amphitheatre-like valley head, formed at the head of a valley glacier by erosion.
CIS	The abbreviation for Community Information Summaries.
clay	A soil particle less than 2 µm in diameter.
climate	The prevailing weather conditions of an area. Climate is a measure of the long-term averages, i.e., normals, of key atmospheric variables, such as temperature, precipitation and wind.
climate change	The change in long-term climate.
CO_2	The chemical symbol for carbon dioxide.
collocate	To set or place together, especially side by side.
colluvium	The name for loose bodies of sediment that have been deposited or built up at the bottom of a low-grade slope or against a barrier on that slope, transported by gravity.
Cook Inlet Natural Gas Liquid Extraction Plant	A facility proposed for development at the end of the mainline pipeline at MP 737 near the Upper Cook Inlet which would separate NGLs from the gas stream and inject utility-grade natural gas into the existing ENSTAR pipeline.
compressor station	A facility containing equipment that is used to increase the pressure in the pipeline to keep the flow of natural gas moving at an appropriate rate.
Construction Phase	The phase of a project preceding the Operations Phase, during which project facilities and infrastructure are assembled and installed, and connected and tested to ensure that they operate as designed.
contingency plans	A plan devised for an exceptional risk which is impractical or impossible to avoid.
corrosion	The disintegration of metal due to a chemical reaction with its surroundings.
critical habitat	• Specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and • Specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

CSIS	The abbreviation for Community Subsistence Information System.
CSU	The abbreviation for Conservation System Unit.
CT	The abbreviation for Census Tract.
CTL	The abbreviation for Coal to Liquids.
cumulative effects	The result of all impact-causing activities that affect a resource while the impacts of the proposed action are occurring or remain in effect.
CWA	The abbreviation for Clean Water Act.
CWMP	The abbreviation for Comprehensive Waste Management Plan. The plan would ensure that hazardous and nonhazardous wastes generated by the proposed Project would be minimized, identified, handled, stored, transported, and disposed of in a safe and environmentally responsible manner.
CZMA	The abbreviation for Coastal Zone Management Act.
DB	The abbreviation for Denali Borough.
dB	The symbol for decibel.
dBA	The abbreviation for A-weighted decibel scale.
DCE	The abbreviation for design contingency earthquake.
decommissioning	The act of taking a processing plant or facility out of service and isolating equipment, to prepare for routine maintenance work, suspending or abandoning.
degree day	A quantitative index demonstrated to reflect demand for energy to heat or cool houses and businesses.
Denali NPP	The abbreviation for Denali National Park and Preserve.
DEW	The abbreviation for Distant Early Warning.
DHS&EM	The abbreviation for Division of Homeland Security & Emergency Management.
diadromous	Fish migrating between fresh and salt water.
dialect	A variety of a language that is a characteristic of a particular group.
direct impacts	Are caused by the action and occur at the same time and place.
discharge	The rate of water flow at a given moment, expressed as volume per unit of time.
DLP	The abbreviation for Defense of Life and Property.

Glossary, Acronyms and Abbreviations (Continued)

DOLWD	The abbreviation for Department of Labor & Workforce Development.
DOT&PF	The abbreviation for Alaska Department of Transportation and Public Facilities.
DSM/EE	The abbreviation for Demand-Side Management and Energy Efficiency.
easement	A certain right to use the real property of another without possessing it.
echolocation	The act of emitting calls out to the environment and listening to the echoes of those calls that return from various objects near them for navigation and foraging.
ecology	The scientific study of the relations that living organisms have with respect to each other and their natural environment.
EFH	The abbreviation for Essential Fish Habitat.
EIA	The abbreviation for Environmental Impact Assessment.
EIS	The abbreviation for Environmental Impact Statement.
EMS	The abbreviation for Environmental Management System.
ENSTAR	The abbreviation for the ENSTAR Natural Gas Company.
environment	The surroundings of an object, or the Natural environment, all living and non-living things that occur naturally on Earth.
Environmental Impact Assessment	An assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects.
Environmental Impact Statement	A document required by the National Environmental Policy Act (NEPA) for certain actions significantly affecting the quality of the human environment.
environmentally sensitive area	A type of designation for an agricultural area which needs special protection because of its landscape, wildlife or historical value.
eolian	To be borne, deposited, produced, or eroded by the wind.
EPA	The abbreviation for Environmental Protection Agency.
ephemeral stream	A seasonal stream that only flows for part of the year.
epidemic	When new cases of a certain disease, in a given human population, and during a given period, substantially exceed what is expected based on recent experience.
ESA	The abbreviation for Endangered Species Act.

ESCP	The abbreviation for Erosion Sediment Control Plan.
ESU	The abbreviation for Evolutional Significant Units.
ethnographic	The branch of anthropology that deals with the scientific description of specific human cultures.
evapotranspiration	The sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.
export pipeline	The export pipeline is not proposed for this Project, but is included as a reasonably foreseeable action. The export pipeline would be a buried 6-8 inch diameter pipeline, extending 80 miles long, beginning at the NGLEP, and following the existing Beluga natural gas line south of the village of Tyonek to MP 58. It would pass under Cook Inlet to Nikiski and terminate at the NGL Fractionation Facility.
Fairbanks Distribution System	Expansion of the local distribution system to transport natural gas from the Fairbanks Lateral terminus to the customers in the Fairbanks area is a reasonably foreseeable future action.
Fairbanks Lateral	The proposed development of a 12 inch diameter pipeline extending approximately 35 miles from the mainline gas line at MP 458 to the Fairbanks Terminus.
Fairbanks Route Variation Alternative	This alternative would follow the existing TAPS/Dalton Highway alignment from Livengood to Fairbanks and then along the Parks Highway/Alaska Railroad to Dunbar.
fault crossings	Crossings proposed for fault rupture zones.
fauna	The animal life of any particular region or time.
FEMA	The abbreviation for Federal Emergency Management Agency.
FERC	The abbreviation for Federal Energy Regulatory Commission.
fiord	A long, narrow inlet with steep sides or cliffs, created in a valley carved by glacial activity.
FL	The abbreviation for Fairbanks Lateral.
flora	The plant life occurring in a particular region or time, generally the naturally occurring native plant life.
FLPMA	The abbreviation for Federal Land Policy and Management Act.
flume	An open artificial water channel, in the form of a gravity chute, that leads water from a diversion dam or weir completely aside a natural flow.
fluvial systems	Relating to flowing water.

Glossary, Acronyms and Abbreviations (Continued)

FNG The abbreviation for Fairbanks Natural Gas.

FNSB The abbreviation for the Fairbanks North Star Borough.

FPC The abbreviation for Fairbanks Pipeline Company.

FPPA The abbreviation for Farmland Protection Policy Act.

FRA The abbreviation for Federal Railway Administration.

frost bulb A frozen zone, typically formed around a chilled pipe, in otherwise unfrozen ground.

frost heave The raising of a surface caused by ice in the underlying soil. This movement results from alternate thawing and freezing. Frost heaving generates stress on vertical support members of pipelines in the Arctic and, as a result, also on the pipeline.

FTA The abbreviation for Federal Transit Administration.

fugitive dust A type of nonpoint source air pollution - small airborne particles that do not originate from a specific point such as a gravel quarry.

G&T The abbreviation for generation and transmission system.

Gas Conditioning Facility An approximately 70-acre facility proposed for installation at MP 0 of the proposed Project that would receive natural gas from an existing central natural gas facility to remove carbon dioxide (CO_2), hydrogen sulfide (H_2S) and other impurities. The natural gas would then be compressed to required delivery pressures, enriched with the addition of NGLs, cooled then transported down the pipeline.

GCF The abbreviation for Gas Conditioning Facility.

geo-fabric Permeable fabrics that have the ability to separate, filter, reinforce, protect, or drain.

geotechnical Geological technical application for construction on or in the ground.

GHG The abbreviation for Green House Gases.

gill net A mesh net made of monofilament with a float line and a lead sinking line to snare fish by their gills as they swim through the net.

GIS The abbreviation for Geographic Information System.

GMP The abbreviation for General Management Plan.

GMU The abbreviation for Game Management Units.

groundwater Subsurface water that is recharged by infiltration and enters streams through seepage and springs.

GVEA	The abbreviation for Golden Valley Electric Association.
H_2S	The chemical symbol for hydrogen sulfide.
habitat	An ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism.
habituate	Make or become accustomed or used to something.
HAP	The abbreviation for Hazardous Air Pollutant.
haul out	The behavior associated with pinnipeds (true seals, sea lions, fur seals and walruses), temporarily leaving the water between periods of foraging activity to lay or rest at sites on land or ice.
HB	The abbreviation for House Bill.
HCA	The abbreviation for High Consequence Areas.
HDD	The abbreviation for Horizontal Directional Drilling.
HEA	The abbreviation for Homer Electric Association.
HECs	The abbreviation for Health Effects Categories.
heritage resources	Cultural, historic, archaeological and paleontological resources, including pre-contact and post-contact features.
HGM	The abbreviation for Hydrogeomorphic Classification.
HIA	The abbreviation for Health Impact Analysis.
hovercraft	A craft capable of traveling over surfaces while supported by a cushion of slow moving, high-pressure air which is ejected against the surface below and contained within a skirt.
HPSA	The abbreviation for Health Professional Shortage Areas.
HRSA	The abbreviation for Health Resources and Services Administration.
HUC	The abbreviation for Hydrologic Unit Code.
hydrology	The study of the movement, distribution, and quality of water.
hydrostatic testing	A way to test leaks in pressure vessels such as pipelines.
hyporheic zone	A region beneath and alongside a stream bed, where there is mixing of shallow groundwater and surface water.
HWE	The abbreviation for Healthy Worker Effect.
IBA	The abbreviation for Important Bird Areas.
ICBTL	The abbreviation for Integrated Coal Biomass-To-Liquids.

Glossary, Acronyms and Abbreviations (Continued)

Ice age	The geological period of long-term reduction in the temperature of the Earth's surface and atmosphere, resulting in the presence or expansion of continental ice sheets, polar ice sheets and alpine glaciers.
IGCC	The abbreviation for Integrated Gasification Combined Cycle.
igneous rock	Rocks formed through the cooling and solidification of magma or lava.
indirect impacts	Are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. (40 CFR § 1508.8) Indirect effects and secondary effects are used interchangeably by FHWA.
INHT	The abbreviation for Iditarod National Historic Trail.
impact	To have an effect on or influence; alter.
impoundment	A body of water, such as a reservoir, made by impounding.
incubation period	The period of time for embryos to reach the alevin stage and emerge from spawning beds.
infrastructure	The set of interconnected structural elements that provide framework supporting an entire structure of development.
interstitial space	An empty space or gap between spaces full of structure or matter.
intertidal	The area that is above water at low tide and under water at high tide.
intrastate	Relating to or existing within the boundaries of a state.
IPCC	The abbreviation for Intergovernmental Panel on Climate Change.
ISO	The abbreviation for International Organization for Standardization.
IWC	The abbreviation for International Whaling Commission.
KOP	The abbreviation for Key Observation Points.
leach	To dissolve out by the action of a percolating liquid.
liquefaction	The process by which saturated, unconsolidated sediments are transformed into a substance that acts like a liquid.
LNG	The abbreviation for Liquefied Natural Gas. A clear, colorless, liquid that forms when natural gas is cooled to around -258 degrees Fahrenheit to reduce its volume for storage and shipping. LNG production would not be included in the proposed Project.

loess	An aeolian sediment formed by the accumulation of wind-blown silt.
LPG	The abbreviation for Liquid Petroleum Gas. LPG includes propane and butane.
LWCF	The abbreviation for Land and Water Conservation Fund.
MSFCMA	The abbreviation for Magnuson-Stevens Fishery Conservation and Management Act.
MACT	The abbreviation for Maximum Achievable Control Technology.
macrohabitat	A large scale habitat presenting considerable variation of the environment, containing a variety of ecological niches, and supporting a large number and variety of complex flora and fauna.
mainline block valve	A valve that restricts or stops the flow of gas to isolate portions of the pipeline.
mainline gas pipeline	The proposed gas pipeline that would extend from Prudhoe Bay at the GCF (MP 0) southbound 737 miles to the Upper Cook Inlet NGLEP.
MAOP	The abbreviation for maximum allowable operating pressure
masking	The perception of one sound is affected by the presence of another sound.
MBTA	The abbreviation for Migratory Bird Treaty Act.
MEA	The abbreviation for Matanuska Electric Association.
median	The numerical value separating the higher half of a sample.
metamorphic rocks	The transformation of an existing rock type (protolith), which is subjected to heat and pressure causing profound physical and/or chemical change.
meter station	A station that analyzes the quality and quantity of natural gas being transferred through a pipeline.
MHT	The abbreviation for Mental Health Trust.
microhabitat	The small-scale physical requirements of a particular organism or population.
migration	A regular journey or movement made in search of new habitat.
mitigation	The elimination, reduction, or control of a project's adverse effects, including restitution for any damage to the environment caused by effects through avoidance, replacement, restoration, compensation or other means.
MLA	The abbreviation for Mineral Leasing Act.

Glossary, Acronyms and Abbreviations (Continued)

ML&P	The abbreviation for Municipal Light & Power.
MLV	The abbreviation for mainline block valve.
MMBtu/hr	The abbreviation for 100 million British thermal units per hour.
MMg	The symbol for million gallons.
MMPA	The abbreviation for Marine Mammal Protection Act.
MMS	The abbreviation for Minerals Management Service.
MMscfd	The abbreviation for million standard cubic feet per day.
module	Sections of pre-fabricated material to construct the GCF.
molt	A loss of plumage, skin, or hair as a regular feature of an animal's life cycle.
monitoring	Periodic inspection to meet the following objectives: • Observe and report on compliance with approval conditions; • Confirm effectiveness of approved protection measures; • Verify the accuracy of impact predictions; • Identify any effects not predicted in the impact assessment.
moraine	Any glacially formed accumulation of unconsolidated glacial debris (soil and rock) which can occur in currently glaciated and formerly glaciated regions.
morphology	The form and structure of an organism or any of its parts.
morphs	A visual or behavioral difference between organisms of distinct populations in a species.
MP	The abbreviation for Milepost.
Mat-Su	The abbreviation for the Matanuska-Susitna.
MT	The abbreviation for metric ton.
MUA	The abbreviation for Medically Underserved Area.
MUPs	The abbreviation for Medically Underserved Populations.
MW	The abbreviation for megawatt.
NAAQS	The abbreviation for National Ambient Air Quality Standards.
natural gas	A naturally occurring gas mixture consisting primarily of methane.
natural gas liquids	Hydrocarbons found in raw natural gas that are separated from the gas as liquids through gas processing. These are valuable byproducts

	of natural gas processing, which include: ethane, propane, butane, iso-butane and pentane.
navigable	Waters that provide a channel for commerce and transportation of people and goods.
NEPA	The abbreviation for National Environmental Policy Act.
NESHAPs	The abbreviation for National Emission Standards for Hazardous Air Pollutants.
NGL Fractionation Facility	This facility would be a reasonably foreseeable action and is not included in the Project as proposed. The NGL Fractionation Facility would include the use of a turbo-expander refrigeration process for NGL extraction and a de-ethanizer stripping column for fractionation of the NGL's. Propane, butane and natural gasoline would be produced.
NGLs	The abbreviation for natural gas liquids. NGL's are hydrocarbons found in raw natural gas that are separated from the gas as liquids through gas processing. These are valuable byproducts of natural gas processing, which include: ethane, propane, butane, iso-butane and pentane.
NGL Distribution Plant and marine terminal	This facility is a reasonably foreseeable action and is not included in the Project as proposed. The NGL Distribution Plant and marine terminal would be associated with the NGL Fractionation Facility located in Nikiski to transport NGL's on VLGC's.
NGLEP	The abbreviation for the Cook Inlet Natural Gas Liquid Extraction Plant. This facility is proposed for development at the end of the pipeline at MP 737 near the Upper Cook Inlet. The NGLEP would remove propane, butane, and pentane NGLs. This facility would contain an inlet and liquid separators, molecular sieve, and a storage facility. After processing, the utility-grade natural gas would be compressed and transferred via a metering station into the ENSTAR (MP 39) gas line.
NHD	The abbreviation for National Hydrography Dataset.
NHPA	The abbreviation for National Historic Preservation Act.
NIOSH	The abbreviation for National Institute for Occupational Safety and Health.
NIP	The abbreviation for Non-native Invasive Plants.
NLCD	The abbreviation for National Land Cover Database.
NMFS	The abbreviation for National Marine Fisheries Service.
NOAA	The abbreviation for National Oceanic and Atmospheric Administration.

NOI	The abbreviation for Notice of Intent.
NO2	The chemical symbol for nitrogen dioxide.
NPRA	The abbreviation for National Petroleum Reserve Alaska.
NPS	The abbreviation for National Park Service.
NRHP	The abbreviation for National Register of Historic Places.
NS	The abbreviation for North Slope.
NSB	The abbreviation for the North Slope Borough.
NSR	The abbreviation for New Source Review.
NWI	The abbreviation for National Wetlands Inventory.
NWR	The abbreviation for National Wildlife Refuge.
ODPCP	The abbreviation for Oil Discharge Prevention and Contingency Plan.
OHA	The abbreviation for Office of History and Archaeology.
old world	Consists of those parts of the world known to classical antiquity and the European Middle Ages. It comprises Africa, Asia, and Europe (collectively known as Afro-Eurasia), plus surrounding islands.
O&M	The abbreviation for Operation and Maintenance.
OMS	The abbreviation for Operation and Material Sites.
Operations Phase	The phase of a project during which the pipeline and associated facilities are operated.
opportunistic	Taking advantage of opportunities as they arise.
ordinary high water mark	Refers to the highest level of water reached by a body of water that has been maintained for a sufficient period of time to leave evidence on the landscape.
organic matter	The fraction of soil that contains plant and animal residues in various stages of decomposition.
overburden	The material that lies above an area of economic or scientific interest in mining and archaeology; most commonly the rock, soil, and ecosystem that lies above a coal seam or ore body.
overwintering period	The period of time during the winter season when temperatures are cold and food and space is limited for fish, making survival difficult.
PA	The abbreviation for Programmatic Agreement.
PACs	The abbreviation for Potentially Affected Communities.

Table of Contents (Continued)

Glossary, Acronyms and Abbreviations (Continued)

Paleo-Arctic tradition The name given by archaeologists to the cultural tradition of the earliest well-documented human occupants of the North American Arctic, which date from the period 8000–5000 BC.

Paleoindians The first peoples who entered, and subsequently inhabited the American continent during the final glacial episodes of the late Pleistocene period.

palsas Low, often oval frost heaves occurring in polar and subpolar climates which contain permanently frozen ice lenses.

palustrine Includes any inland wetland which lacks flowing water, contains ocean-derived salts in concentrations of less than 0.05%, and is non-tidal.

PCBs The abbreviation for polychlorinated biphenyls.

pelagic Water in a sea or lake that is not close to the bottom or near to the shore.

permafrost Soil that is at or near the freezing (32˚F) point of water for two or more years.

PHC The abbreviation for petroleum hydrocarbon.

PHMSA The abbreviation for Pipeline and Hazardous Materials Safety Administration.

photosynthesis Is the process of converting light energy to chemical energy found in plants and algae and storing it in the bonds of sugar.

PI The abbreviation for Points of Inflection.

pig A pig is a mechanical tool used to clean and/or inspect the interior of a pipeline.

pig launcher A facility on a pipeline for inserting and launching a pig.

pig receiver A piping arrangement whereby an incoming pig can be diverted into a receiving cylinder isolated and then removed.

pingo A mound of earth-covered ice found in the Arctic and subarctic that can reach up to 230 ft in height and up to 2,000 ft in diameter.

PJD The abbreviation for Preliminary Jurisdictional Determination.

PM The abbreviation for Particulate Matter.

POA The abbreviation for Port of Anchorage.

POD The abbreviation for Plan of Development.

polynya An area of open water surrounded by sea ice.

POS	The abbreviation for the Port of Seward.
prehistory	The span of time before recorded history.
productivity	The quantity of organic matter or its equivalent in dry matter, carbon, or energy content which is accumulated during a given period of time.
Project facilities	Are aboveground facilities required for pipeline operation including: a GCF, compressor stations, straddle and off-take facility, NGLEP, meter stations, mainline valves, pig launcher and receivers.
protohistory	A period between prehistory and history, during which a culture or civilization has not yet developed writing, but other cultures have already noted its existence in their own writings.
PSD	The abbreviation Prevention of Significant Deterioration.
psig	The abbreviation for pounds per square inch gauge.
PSIO	The abbreviation for Petroleum Systems Integrity Office.
PWSs	The abbreviation for Public Water Systems.
QAP	The abbreviation for Quality Assurance Program.
RCRA	The abbreviation for Resources Conservation and Recovery Act.
rearing period	The period of time where young fish feed and grow.
reclamation	The process of reclaiming (return to a suitable condition for use) something from loss or from a less useful condition.
rehabilitation	The reparation of ecosystem processes, productivity and services but does not necessarily mean a return to pre-existing biotic conditions.
restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Also, Restoration attempts to return an ecosystem to its historic trajectory.
richness	The number of different species in a given area.
Richardson Highway Route Alternative	The route would extend from Livengood, southeast to Fairbanks adjacent to the TAPS ROW; then parallel the Richardson Highway up the Tanana River Valley to Delta, turn south and follow the Delta River Valley to Isabel Pass and cross the Gulkana River. It would follow the Glenn Highway south west to Caribou Creek, Boulder Creek terminating at the Matanuska River at MP 55 of the ENSTAR Beluga Gasline.
right-of-way	The pipeline easement in which the pipeline will be installed and operated. The pipeline right-of-way width for the project will vary dependant on land ownership.

Glossary, Acronyms and Abbreviations (Continued)

riparian	Situated or dwelling on the margin of a river or other waterbody.
RIRP	The abbreviation for Regional Integrated Resource Plan.
RMPs	The abbreviation for Resource Management Plans.
rookery	A colony of breeding animals, generally birds.
ROW	The abbreviation for right-of-way.
rut period	The mating season of ruminant animals such as deer, sheep, moose, caribou, and goats.
SCADA	The abbreviation for Supervisory Control and Data Acquisition.
SCORC	The abbreviation for Statewide Comprehensive Outdoor Recreation Plan.
SDH	The abbreviation for Social Determinants of Health.
SDWA	The abbreviation for Safe Drinking Water Act.
sedimentary rocks	Are formed by the deposition of material at the Earth's surface and within bodies of water.
sedimentation	The tendency for particles in suspension to settle out of the fluid in which they are entrained, and come to rest against a barrier.
SEIS	The abbreviation for Supplemental Environmental Impact Statement.
semi-subterranean houses	Houses built half below the surface of the ground.
SERC	The abbreviation for State Emergency Response Commission.
SES	The abbreviation for Seward Electrical Association.
sexually dimorphic	A phenotypic difference between males and females of the same species.
SF	The abbreviation for State Forest.
SFHAs	The abbreviation for Special Flood Hazard Areas.
shore fast ice	Sea ice that has frozen along coasts along the shoals, or to the sea floor over shallow parts of the continental shelf, and extends out from land into sea.
SHPO	The abbreviation for State Historic Preservation Office.
SIP	The abbreviation for State Implementation Plan.
SMAP	The abbreviation for Susitna Matanuska Area Plan.

Glossary, Acronyms and Abbreviations (Continued)

SNC	The abbreviation for Significant Non-Complier.
SOC	The abbreviation for Synthetic Organic Contaminants.
sociocultural	Relating to or involving a combination of social and cultural factors.
SP	The abbreviation for State Park.
SPCCP	The abbreviation for Spill Prevention Control and Countermeasure Plan.
SPCO	The abbreviation for State Pipeline Coordinators Office.
SPCP	The abbreviation for Spill Prevention and Control Plan. The plan would address O&M of vehicles, storage of fuels and other hazardous materials, containment requirements, liquid and solid storage and waste disposal, spill response and cleanup procedures, reporting requirements, and periodic inspection and documentation requirements.
SPL	The abbreviation for Sounds Pressure Level.
spoil	Refuse material removed from excavation.
spring	A place where ground water flows naturally from a rock or soil onto the land surface.
SRA	The abbreviation for State Recreational Area.
SRMAs	The abbreviation for Special Recreation Management Areas.
SRR Plan	The abbreviation for Sedimentation, Rehabilitation and Restoration Plan.
straddle and off-take facility	A facility proposed to be located at the Fairbanks Lateral tie-in at MP 458.1 of the mainline gas line that would remove NGL's from the natural gas to allow utility-grade gas to enter the Fairbanks Lateral. Extracted NGL's would be injected back into the mainline natural gas line.
stock	Subpopulations of a particular species.
subnivean	Refers to a zone that is in or under the snow layer.
substrate	The material that makes up the bottom layer of the stream, such as gravel, sand, or bedrock.
subtidal zone	The zone that is exposed to air at the lowest of low tides and is primarily marine in character.
succession	The series of changes in an ecological community that occur over time after a disturbance.

Glossary, Acronyms and Abbreviations (Continued)

SWCD	The abbreviation for Soil and Water Conservation District.
SWPPP	The abbreviation for Storm Water Pollution Prevention Plan.
TAGS	The abbreviation for Trans-Alaska Gas System.
taiga	Is also known as the boreal forest, is a biome characterized by coniferous forests.
“take”	The act of hunting, killing, capture, and/or harassment of any marine mammal; or, the attempt at such.
TAPS	The abbreviation for the Trans Alaska Pipeline System.
TC Alaska	The abbreviation for the TransCanada Alaska Company, LLC.
TCE	The abbreviation for Temporary Construction Easement.
TCPs	The abbreviation for Traditional Cultural Properties.
TEG	The abbreviation for Thermo-Electric-Generator.
TEK	The abbreviation for Traditional Ecological Knowledge.
temperate	Latitudes on the globe that are above the tropics and below polar circles.
temporal	Relating to time.
TEWS	The abbreviation for Temporary Extra Workspaces.
thermokarst	The melting of permafrost by heat transfer from water bodies resulting in a depression.
thermoregulation	The ability of an organism to keep its body temperature within certain boundaries, even when the surrounding temperature is very different.
thoracic	Refers to the chest area.
threshold	The point that must be exceeded to begin producing a given effect or result or to elicit a response.
Thule people	The first true ancestors of Alaska’s Inupiat groups.
till	Unsorted glacial sediment.
TMDL	The abbreviation for total maximum daily load.
TPY	The abbreviation for Tons Per Year.
traditional knowledge	Cultural knowledge that is based on direct observation or information passed on orally from other community members, developed from centuries of experience of living off the land.

Table of Contents (Continued)

Glossary, Acronyms and Abbreviations (Continued)

TLUI	The abbreviation for Traditional Land Use Inventory.
tributary	A stream that flow into another river or stream.
TUC	The abbreviation for Transportation and Utility Corridor.
µm	The symbol for microns.
UNFCCC	The abbreviation for United Nations Framework Convention on Climate Change.
upwelling	Areas where water flows from the stream bed up into the water column.
USACE	The abbreviation for United States Army Corps of Engineers.
USCG	The abbreviation for United States Coast Guard.
USDA	The abbreviation for United States Department of Agriculture.
USDOD	The abbreviation for United States Department of Defense.
USDOI	The abbreviation for United States Department of the Interior.
USDOT	The abbreviation for United States Department of Transportation.
USEPA	The abbreviation for United States Environmental Protection Agency.
USFWS	The abbreviation for United States Fish and Wildlife Service.
USGS	The abbreviation for United States Geological Survey.
VdB	The abbreviation for vibration decibels.
vegetation community	A distinct grouping of plant species often associated with a particular set of environmental conditions such as terrain, soil, permafrost and water. Also known as plant community.
vertical support members	Aboveground steel support structures used to elevate the pipeline for the first 6 miles of the proposed Project.
VLGC	The abbreviation for Very Large Gas Carrier.
VOC	The abbreviation for Volatile Organic Compound.
VRM	The abbreviation for Visual Resource Management.
VSM	The abbreviation for Vertical Support Members.
waterbody	A body of water that is a significant accumulation of water covering the earth which includes wetlands, streams, rivers, lake or ocean.
water crossing	A location where a pipeline or access road crosses a stream, river or lake.

Glossary, Acronyms and Abbreviations (Continued)

watershed	A region or area draining into a particular stream or river.
weather	The state of the atmosphere at a place and time considering temperature, cloud cover, humidity, wind and precipitation.
WELTS	The abbreviation for Well Log Track System.
wetland	An area of land whose soil is saturated with water either permanently or seasonally.
WHO	The abbreviation for World Health Organization.
wintering ground	The location where a species inhabits for the winter period.
WQS	The abbreviation for Water Quality Standards.
ZRA	Zone of Restricted Activity

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Billing Code 3720-58

DEPARTMENT OF DEFENSE

Department of the Army, U.S. Army Corps of Engineers

Notice of Availability of the Final Environmental Impact Statement for the proposed Alaska Stand Alone Gas Pipeline, in the State of Alaska

AGENCY: Corps of Engineers, Department of the Army, Department of Defense

ACTION: Notice of Availability

SUMMARY: In accordance with the National Environmental Policy Act (NEPA), the U.S. Army Corps of Engineers (USACE), Alaska District, has prepared a Final Environmental Impact Statement (FEIS) on the proposed development by the Alaska Gasline Development Corporation (Applicant). The FEIS evaluates project alternatives and potential impacts to the environment which may occur from the Applicant's proposal to construct, operate, and maintain approximately 737 miles of new 24-inch-diameter pipeline from the North Slope of Alaska near Prudhoe Bay to Anchorage and the Cook Inlet area, with a 12-inch-diameter lateral line to Fairbanks. The proposed project includes the discharge of dredged and/or fill materials into waters of the US, including wetlands. The proposed work requires authorization from the Corps of Engineers under Section 10 of the Rivers and Harbors Act (RHA) of 1899 and Section 404 of the Clean Water Act (CWA). The FEIS will be used to evaluate the Applicant's Department of the Army permit application and compliance with NEPA.

Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) required the Bureau of Land Management (BLM) to evaluate the effects of plans presented in the DEIS on subsistence activities in the area of the proposed action and alternatives, and to hold public hearings where any alternative may significantly restrict subsistence activities. The analysis of environmental consequences indicated the proposed action may significantly restrict subsistence in the cumulative case. Therefore, the BLM held public hearings on subsistence in conjunction with the public meetings discussed in the *Draft EIS review* process below and wrote a Final ASAP ANILCA Section 810 Analysis of Subsistence Impacts to be included within the FEIS as an appendix.

30-Day Review: The Final EIS is open for public comment. The 30-day comment/review period begins on October 26, 2012, and ends on November 26, 2012. The Record of Decision on the proposed action will be issued after the public interest review is complete. However, this process cannot begin until USACE receives a complete Department of the Army permit application.

FURTHER INFORMATION: Contact Mary Romero by e-mail at mary.r.romero@usace.army.mil, or by telephone at 800-478-2712 (toll free within AK) or 907-753-2773.

SUPPLEMENTARY INFORMATION:
1. Authorities: Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

2. Background Information: The Corps of Engineers, Alaska District, received a preliminary permit application in September 2011. The Applicant's purpose is to construct a pipeline from Alaska's North Slope to Cook Inlet in the south.

3. Location: North Slope of Alaska near Prudhoe Bay to Anchorage and the Cook Inlet area, with a lateral line to Fairbanks. The proposed project is located entirely within the state of Alaska and follows the Dalton and Parks Highways for the majority of the route.

4. *Proposed Project*: The applicant proposes the construction and operation of a pipeline to transport natural gas and natural gas liquids (NGLs). The pipeline would transport natural gas and NGLs from existing reserves within Prudhoe Bay gas fields on the North Slope of Alaska for delivery to in-state markets in Fairbanks and Southcentral Alaska. The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. The gas and NGLs would be used to: heat homes, business and institutions; generate electrical power; and for potential industrial uses.

5. *Final EIS Alternatives*: There is one alternative to the proposed Project and one variation:

- No Action Alternative – the proposed Project would not be constructed and would not operate;
- Denali National Park and Preserve Route Variation – would go through the National Park and would require the passage of legislation.

6. *Scoping Process*: A Notice of Intent to prepare a Draft EIS (DEIS) for the Alaska Stand Alone Gas Pipeline was published on December 4, 2009. The Corps of Engineers conducted public, Tribal, and agency scoping meetings in Alaska prior to preparing the DEIS. Results from the scoping process were summarized in a Public Scoping Document and are included in the FEIS.

7. *Draft EIS Review*: The Draft EIS comment period began on January 20, 2012, with the publication of the Notice of Availability in the Federal Register. The comment period was originally scheduled to end on March 5, 2012, but was extended to April 4, 2012, after requests for an extension were received. Open house and public comment meetings were held between February 13 and April 2, 2012, in Anchorage, Anaktuvuk Pass, Barrow, Cantwell, Coldfoot, Fairbanks, Kenai, Minto, Nenana, Talkeetna, and Willow. The Corps of Engineers received over 1200 comment submissions during the comment period. Comments were culminated and the text was edited and clarified based on a review conducted by USACE and the cooperating agencies. They are presented in the FEIS as Appendix S.

8. *Availability of the Final EIS:* Electronically available for viewing, copying, or printing at www.asapeis.com. A printed Executive Summary, which includes the entire FEIS on one CD, can be obtained by submitting an electronic notification through the project website or by contacting Mary Romero via e-mail at mary.r.romero@usace.army.mil, by telephone at 800-478-2712 (toll free within AK) or 907-753-2773.

9. *Public Locations for Final EIS:* The FEIS is available for review at the following public libraries and schools:

ANAKTUVUK:
Community Center, 661-3612

ANCHORAGE:
Alaska Resources Library and
Information Services (ARLIS)
3150 C Street, Suite 100
(907) 272-7547

Alaska Department of Natural Resources Public
Information Center
550 W. 7th Ave Ste 1260
(907) 269-8400

Z. J. Loussac Public Library
3600 Denali Street
(907) 343-2975

Bureau of Land Management
Alaska State Office Public Information Center
222 West 7th Ave. #13
(907) 271-5960

UAA/APU Consortium Library
3211 Providence Drive
(907) 786-1871

BARROW:
Tuzzy Consortium Library
5421 North Star Street
(907) 852-1720

CANTWELL:
Cantwell Community Library
1 School Road
(907) 768-2372

DENALI PARK:
Denali National Park Library
MI 237 Parks Hwy
(907) 683-2294

HEALY:
Tri-Valley School/Community Library
907-683-2267 (ext. 18)

FAIRBANKS:
Fairbanks North Star Borough Public Library
1215 Cowles Street
(907) 459-1020

Bureau of Land Management
Public Room, 1150 University Avenue
(907) 474-2200

Alaska Department of Natural Resources
Public Information Center
3700 Airport Way
(907) 451-2705

KENAI:
Kenai Library, 283-4378

MINTO:
Minto School Library, (907) 798-7212

NENANA:
Nenana Public Library, (907) 832-5812

NIKISKI: Nikiski North Star Elementary School Library, (907) 776-3456

TALKEETNA:
Talkeetna Public Library, (907) 733-2359

TRAPPER CREEK:
Trapper Creek Public Library, (907) 683-2294

WASILLA:
Wasilla Public Library
391 North Main Street, (907) 376-5913

WILLOW:
Willow Public Library, 907-495-7323

Further information is available on the project website at www.asapeis.com.

Requests to be placed on a mailing list for the public notice due after a complete application is received can be sent to regpagemaster@usace.army.mil or at the contact information above.

Receipt of this signed document ensures transmittal has been completed.

Date: 9 OCT 12

Approved by:

Christopher D. Lestochi
Colonel, Corps of Engineers
District Commander

INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Alaska District and six cooperating agencies have prepared a Final Environmental Impact Statement (FEIS) for the proposed Alaska Stand Alone Gas Pipeline (ASAP) Project (the proposed Project). The FEIS describes the proposed Project and evaluates the potential direct, indirect and cumulative environmental impacts associated with the proposed action and alternatives, including the No Action Alternative. Applicant proposed measures to mitigate adverse impacts are identified and described. The FEIS has been prepared to address issues and alternatives raised during the scoping process and the Draft Environmental Impact Statement (DEIS) review and comment process.

The USACE gave full consideration to all public comments received on the DEIS. A summary of the public meetings, written comment letters, and responses is presented in Section 1.5 and Appendix S of the FEIS.

The EIS process is being conducted to comply with the National Environmental Policy Act (NEPA). The steps of the EIS process are described in Figure ES-1.

This Executive Summary of the FEIS provides an overview of the proposed Project, the purpose and need for the proposed Project, the public involvement process including areas of concern raised during the scoping process, the DEIS distribution and comment process, the alternatives to the proposed Project considered, and the conclusions drawn regarding potential environmental impacts. Additional detailed information on these aspects is presented in the FEIS.

FEIS REFINEMENTS

Select information presented in the FEIS has been updated and refined since the DEIS was issued on January 20, 2012. Updated and refined information includes:

Reaching a Decision: The new Section 4.7 of the FEIS explains the USACE's process for determining the agency preferred action and for reaching decisions. The agency preferred actions of the BLM and SPCO are also described.

Text Revisions: Text revisions have been made throughout the document to respond to public DEIS comments, to update the analysis with additional information, and for clarity. Additional proposed Project details regarding the pipeline ROW, Temporary Extra Work Spaces (TEWS), and access roads are described in Section 2.0 and analyzed in Sections 5.1- 5.19.

Mitigation: The discussion of applicant proposed mitigation in the FEIS has been consolidated into new Section 5.23, Mitigation. Additional information has also been added regarding the effectiveness of applicant proposed mitigation measures.

Connected Actions: Discussion and analysis of environmental impacts associated with future potential processing and distribution of natural gas liquids has been moved from Section 3.0, which addresses connected actions, to Section 5.20, which addresses cumulative effects. This change does not alter the substance of the impact analysis, but more accurately identifies NGL processing and distribution as a future foreseeable action, instead of a present connected action.

Conclusions: The summary of conclusions in Section 6.0 has been expanded in the FEIS to compare the proposed action and the range of alternatives analyzed through the NEPA process. A ranking matrix of potential effects is also included.

Appendices: Several appendices have been updated with new or more detailed information. New appendices include: Appendix O – Air Quality Summary of Potential-To-Emit (PTE) Calculations; Appendix P – Existing Material Sites; and Appendix S – Public Comment Matrix.

ASAP PROJECT COMPONENTS

Pipelines:

- 737 miles of 24-inch diameter pipeline extending from Prudhoe Bay to a point near Port MacKenzie, Alaska
- 34 miles of 12-inch diameter lateral pipeline extending from Dunbar to Fairbanks, Alaska

Aboveground Facilities:

- A North Slope gas conditioning facility (GCF)
- A straddle and gas off-take facility near Dunbar
- A Cook Inlet NGL extraction plant (NGLEP) facility
- 1 or 2 compressor stations
- 3 meter stations
- 37 mainline valves at intervals not greater than 20 miles

Support Facilities:

- Operations and maintenance buildings
- Construction camps and pipeline yards; and material sites

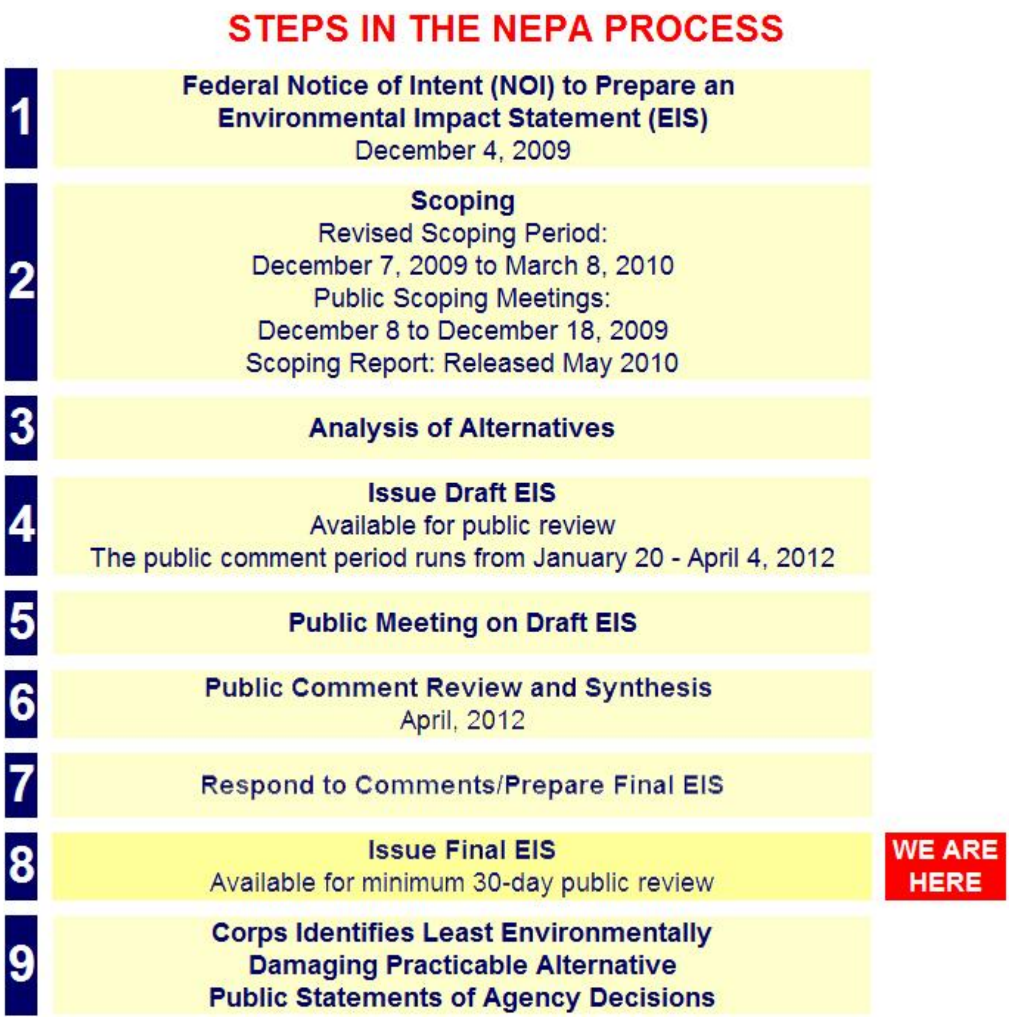
Yukon River Crossing Options: The DEIS identified and analyzed the environmental impacts of three possible crossing options for the Yukon River. Recently, AGDC was required to identify one of the three options as its preferred route and method. AGDC identified construction of a new aerial suspension bridge (DEIS "Option 1" / FEIS "the Applicant's Preferred Option") as its preferred location and design for the Yukon River crossing. This change is explained in Section 2 of the FEIS; however, because of the late timing of this new information, the FEIS was not otherwise reorganized because the existing analysis and comparison of impacts resulting from all three Yukon River crossing options remains relevant and accurate for purposes of NEPA and federal permitting decisions to follow.

BACKGROUND

The proposed Project is being planned as an in-state natural gas pipeline designed to provide long-term, stable supplies of natural gas from the North Slope to the Fairbanks, Anchorage and the Cook Inlet area of Alaska.

In March 2010, the Alaska legislature mandated that the State prepare a project plan for an in-state natural gas pipeline. This mandate also established a joint in-state gasline development team to prepare the project plan. The development team is led by the Alaska Housing Finance Corporation, which created a subsidiary corporation called the Alaska Gasline Development Corporation (AGDC). The AGDC was established in July 2010 and became the applicant for the proposed Project.

Figure ES-1: Steps in the Environmental Impact Statement Process



PROPOSED ACTION

The AGDC proposes to construct, operate, and maintain approximately 737 miles of a new 24-inch-diameter pipeline. A map of the proposed Project area can be viewed in Figure ES-2. The proposed Project would transport up to 500 million standard cubic feet per day (MMscfd) of natural gas and natural gas liquids (NGLs) from North Slope gas fields to markets in the Fairbanks, Anchorage and the Cook Inlet area by 2019. The pipeline would have a maximum allowable operating pressure of 2,500 pounds per square inch. Additionally, a new 12-inch-diameter lateral pipeline would extend approximately 34 miles from Dunbar east to Fairbanks. The general location of the proposed Project facilities is shown in Figure ES-2. The AGDC anticipates that initial natural gas flow would be less than 250 MMscfd, but a peak capacity of 500 MMscfd has been proposed to meet anticipated future demands.

The proposed Project would connect with the existing central gas facility (CGF) near Prudhoe Bay, provide for connection to a future Fairbanks natural gas distribution system to be constructed by others, and connect to ENSTAR Natural Gas Company's (ENSTAR) existing pipeline system located near Port MacKenzie in Southcentral Alaska (Anchorage and the Cook Inlet area).

The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. Based upon meeting an optimum schedule, the transport of gas and NGLs would begin in 2019. The gas and NGLs would be used to heat homes, businesses and institutions, to generate electrical power, and for potential industrial uses. Further information regarding the proposed Project is presented in Section 2.0 of the FEIS.

CONNECTED ACTIONS

Connected actions would be required for the proposed Project to operate as planned. These connected actions are not proposed by the AGDC and would be completed by others:

- Construction and operation of four aboveground pipelines that would connect the Prudhoe Bay CGF to the gas conditioning facility (GCF) for supply of natural gas and NGLs and return of bi-products. The aboveground pipelines would be approximately 1,000 ft. in length.

Further information regarding connected actions is presented in Section 3.0 of the FEIS.

PURPOSE AND NEED FOR THE PROPOSED ACTION

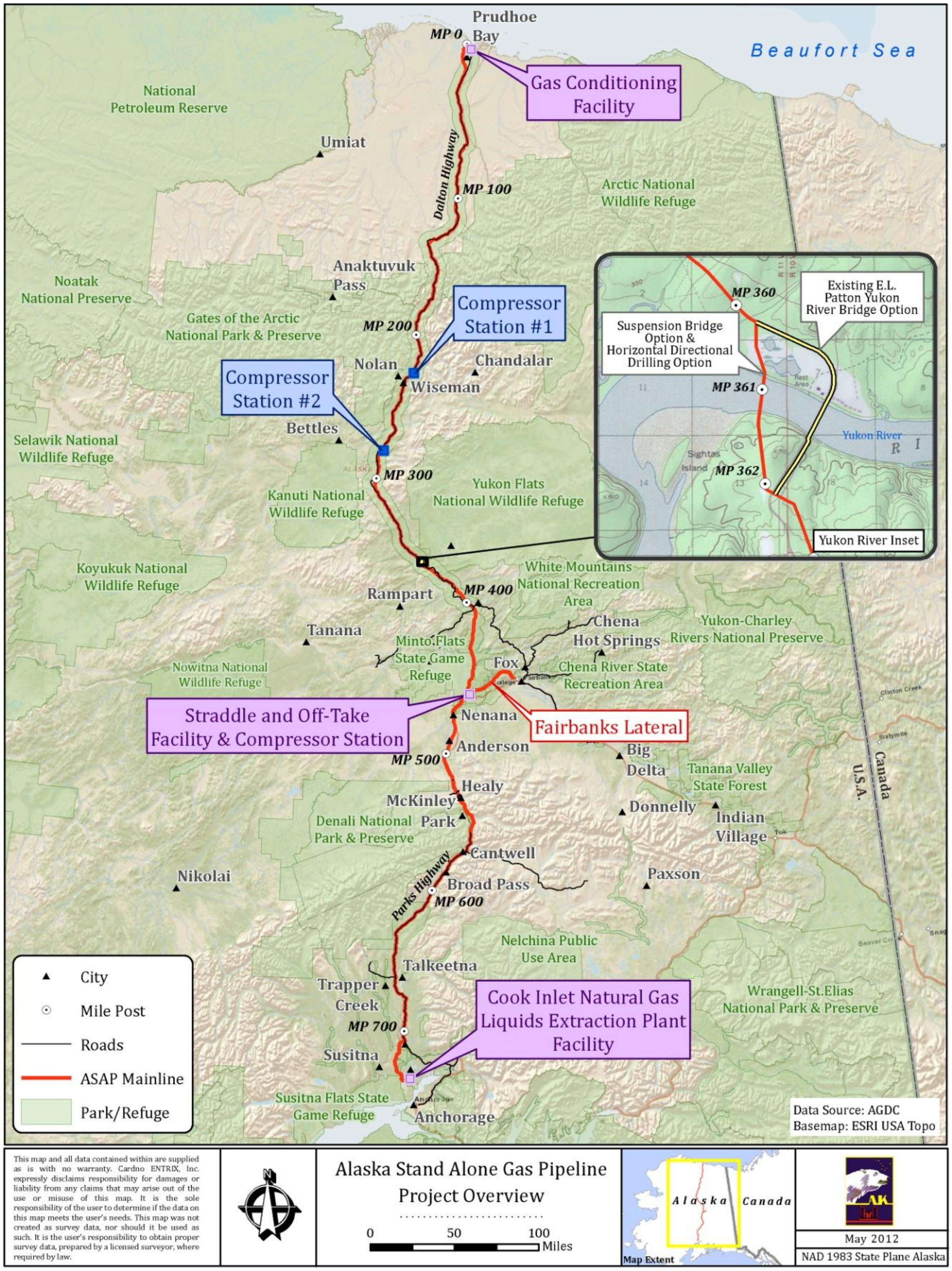
The primary purpose of the proposed Project is to provide a long-term, stable supply of up to 500 MMscfd of natural gas and NGLs from existing reserves within North Slope gas fields to markets in the Fairbanks, Anchorage and the Cook Inlet area by 2019. A secondary purpose is to utilize proven gas supplies that are readily available on the North Slope to provide economic benefit to the State of Alaska through royalties and taxes.

As identified by the State legislature, a long-term, affordable energy source is needed for Fairbanks and Southcentral Alaska. Residential, community, commercial, and industrial entities would benefit from a reliable supply of natural gas. Existing and future energy users need access to reliable cost-effective energy. The proposed Project would fulfill the following needs:

- Relieve a shortfall of natural gas supply in the Cook Inlet area, which is the primary fuel source for heating and electrical power generation, projected in the near future (2013-2015);
- Provide for conversion from existing heating sources to natural gas in Fairbanks in order to reduce harmful air emissions. This would in turn assist in achieving attainment status. Fairbanks currently is in air pollution non-attainment area status due to particulate matter. Use of oil and wood for heating are major contributors to the problem of air pollution in winter;
- Provide a stable and reliable supply of natural gas and NGLs to meet current and future energy demands of up to 500 MMscfd;
- Provide a stable and reliable supply of natural gas needed to spur economic development of commercial and industrial enterprises in Fairbanks and the Cook Inlet area; and
- Provide economic benefit to the State of Alaska through royalties and taxes. Approximately 82 percent of Alaska's estimated state revenues for 2010 were from oil taxes, royalties, and fees.

Further information regarding the purpose and need for the proposed Project is presented in Section 1.0 of the FEIS.

Figure ES-2: Project Overview Map



SCOPING PROCESS

On December 4, 2009, the USACE published the Notice of Intent (NOI) to prepare an EIS in the *Federal Register*. On the same date, the USACE sent a public notice to affected parties regarding the EIS public scoping meetings and how to obtain more information on the proposed Project. The NOI initiated the scoping period, which was originally scheduled to begin December 7, 2009, and close on February 5, 2010. In response to public request, the scoping period was extended to March 8, 2010. This extension was announced through a Public Notice distributed to interested parties on February 5, 2010.

Public Scoping Meeting at the Anchorage Senior Activity Center

Photo: NRG

Public Scoping Meetings

The USACE hosted eight public meetings in the vicinity of the proposed Project corridor in December 2009. The purpose of these meetings was to disseminate Project information, solicit public input, and identify issues and concerns that the public believed should be addressed in the EIS. The scoping meetings were minimally attended with a few public comments received in some locations. Three scoping meetings did not receive any attendees. Much of the discussion by those in attendance focused on details regarding design, alignment, and the relationship of the proposed Project to other gas pipeline projects.

An agency scoping meeting was held on December 18, 2009, at the Bureau of Land Management (BLM) office in Anchorage. This meeting provided a specific opportunity for agencies to hear the scoping meeting presentation and to ask questions of clarification regarding the proposed Project. The presentation and discussion served as a common foundation for identification of issues and concerns by federal and state agencies with jurisdiction and responsibility for resources potentially affected by the proposed Project.

Comments Received and Issues Identified during Scoping

Seventeen unique comment submissions were received during the scoping period, including four from state or federal agencies, one from local government, one from a state representative, and eleven from non-profit organizations, businesses and the general public. In addition, oral comments were provided and recorded at all meetings, with the exception of the agency meeting in Anchorage and the scoping meetings with no attendance (Glennallen, Delta Junction, and Wasilla). All scoping submissions and comments from members of the public can be seen in their entirety in Appendix E of the Scoping Report (Appendix B of the FEIS).

DRAFT EIS DISTRIBUTION AND COMMENT PROCESS

The Draft EIS for the proposed Project was issued for public review on January 9, 2012, and the Notice of Availability (NOA) was subsequently published by the USEPA in the Federal Register (77 FR No. 13) on January 20, 2012. The NOA and a newsletter was distributed to the stakeholder mailing list, which includes agencies, elected officials, media organizations, tribes, private landowners, and other interested parties. The NOA announced public meetings and a 45-day review and comment period that began on January 20, 2012, and was scheduled to end on March 5, 2012. The public comment period was subsequently extended an additional 30 days and formally concluded on April 4, 2012.

The Draft EIS was posted on the Project web site and made available in 19 libraries and information centers in Alaska. The USACE held public meetings in Kenai, Anaktuvuk Pass, Fairbanks, Nenana, Cantwell, Trapper Creek, Willow, Anchorage, Barrow, Wiseman/Coldfoot, and Minto between February 13 and April 2, 2012. The meetings consisted of an open house/presentation format to provide the public with updates on the proposed Project that was followed by the submission of public comments. The USACE received a total of 44 written comment letters during the Draft EIS comment period of January 20 through April 4, 2012 via letters, e-mails, website forms, and formal public hearings. Comments were received from elected officials, Federal, state, and local agencies, organizations, and citizens. In addition, oral comments were submitted by 37 people at the public meetings, which were transcribed by a registered professional reporter.

A team of specialists reviewed all comment letters and meeting transcripts and comments requiring specific responses were identified. Comments and responses are provided in tabular form in Appendix S. The text of the Final EIS has been revised where appropriate to address the comments. Additional information, either requested or provided by public input, has been incorporated into the Final EIS.

ALTERNATIVES CONSIDERED

Implementation of the NEPA through the EIS process requires consideration of reasonable alternatives to the proposed Project that could minimize impacts to the natural and human environment. Consideration of the No Action Alternative is also required.

Alternatives to the proposed Project are described in detail in Section 4.0 of the FEIS. Several types of potential alternatives to the proposed Project have been considered:

- No Action Alternative – the proposed Project would not be constructed and would not operate;
- Energy Source Alternatives – energy alternatives and energy conservation measures that could reduce or replace the North Slope natural gas and NGLs that would be transported by the proposed Project;
- Natural Gas Transport System Alternatives – other systems that could transport the North Slope natural gas and NGLs that would be transported by the proposed Project;
- Pipeline Route Alternatives – alternative pipeline routes and route segment variations; and
- Aboveground Facility Alternatives – alternative aboveground facility sites.

The potential alternatives that were identified are evaluated for:

- Consistency with the purpose and need for the proposed Project as stated in Section 1.2 of the EIS;
- Technical and logistical feasibility, and reasonableness; and
- Environmental advantages over the proposed Project.

No Action Alternative

The No Action Alternative is defined as the proposed action not being undertaken. The short-term and long-term environmental impacts identified in this FEIS would not occur, as the proposed pipeline and associated aboveground facilities would not be constructed and 500 MMscfd of North Slope natural gas and NGLs would not be transported and made available to Fairbanks, Anchorage, and the Cook Inlet area. While selection of the No Action Alternative eliminates the negative impacts, this choice also eliminates the positive impacts associated with the Proposed Action. Unrealized benefits would include: a reliable long-term natural gas supply for Fairbanks and Southcentral Alaska; improved air quality in the Fairbanks area; revenues to the State of Alaska from gas sales, taxes and royalties; and jobs related to construction and operation of the proposed Project.

The current annual demand for Cook Inlet natural gas would remain at approximately 200 MMscfd, and future demand would grow to approximately 250 MMscfd by 2030. In Fairbanks, current and future demand of 60 MMscfd would not be met.

Energy conservation programs and new facilities that generate electricity and heat from sources other than natural gas could reduce, but not fully provide for the current and future demand for natural gas as the existing Cook Inlet supply would continue to diminish. As described in Section 1.2.2 of the FEIS, the natural gas shortage is projected to become acute by 2015.

Energy Source Alternatives

The Alaska North Slope gas fields are a proven, stable and reliable source of natural gas and could be developed to provide a supply of natural gas and NGLs for the proposed Project by the scheduled 2019 start of pipeline operations. According to a 2009 report by the Department of Energy, discovered technically recoverable natural gas resources on the North Slope are estimated to be about 35 trillion cubic feet. Energy sources other than North Slope natural gas were examined as potential alternatives to the proposed Project that could reduce or replace the need for natural gas and NGLs that would be transported by the proposed Project. Several alternative energy resources in the proposed Project area are currently being developed or are in the planning and feasibility analysis process.

Studies indicate that energy sources other than North Slope natural gas and NGLs could reduce but not replace the volume of gas or the electrical power-generating capacity of the gas that would be transported by the proposed Project. None of the identified energy alternatives would meet all objectives of the proposed Project purpose and need. Although some projects would provide alternative means for generating electrical power, they would only individually and collectively partially replace the electrical power generating capacity of the gas that would be transported by the proposed Project; they would also not provide the natural gas needed for home and institutional heating and industrial purposes. Energy alternatives, including major new supplies of Cook Inlet natural gas, are unproven or could not be realized by 2019, the planned in-service date for the proposed Project. Additionally, the economic benefits of utilizing an in-state gas source would not be realized by several of the alternatives. Therefore, alternative energy projects are likely to be developed independently of the proposed Project.

Natural Gas Transport System Alternatives

Past experience indicates that pipelines are cost-effective means of transporting large volumes of natural gas over long distances for sustained periods of time. As part of the FEIS assessment, alternatives to the proposed 24-inch-diameter pipeline were examined that may have the potential to meet the purpose and need of the proposed Project and minimize environmental effects. In comparison to the proposed Project, transportation system alternatives would make use of existing, modified, or proposed natural gas delivery systems to meet the stated objectives of the proposed Project.

Alternative natural gas transportation systems considered and assessed were as follows:

- **A dry gas pipeline**. The purpose and need of the proposed Project would not be met because a dry gas line would not provide NGLs at the pipeline terminus.
- **A smaller diameter pipeline with additional compression**. This was examined to evaluate if a reduction in proposed Project construction and permanent Right-of-Way (ROW) footprint and corresponding reduction in impacts to associated environmental resources could be achieved. A benefit of increased compression (maintaining higher operating pressure) is that the required diameter of the pipeline may be decreased. However, the ROW footprint would not be reduced. Crucially, to increase and maintain compression across the length of the over 737-mile-long pipeline, more compressor stations would be required, bringing with them attendant environmental impacts.
- **Spur pipelines from a large North Slope-to-Lower 48 or Valdez Pipeline**. The Alaska Pipeline Project (APP) has been proposed by TransCanada Alaska Company, LLC and ExxonMobil Corporation. The APP would be a 48-inch-diameter natural gas pipeline beginning at a new gas treatment plant to be constructed near existing Prudhoe Bay facilities. Two alternative routes have been proposed for the APP: the Alberta option and the Valdez LNG option. In March 2012, APP and Alaska North Slope gas producers ConocoPhillips and BP agreed to work together on evaluating options for a large-scale liquefied natural gas (LNG) export facility from Southcentral Alaska as an alternative to a natural gas pipeline through Alberta[1]. In addition to Valdez, Nikiski is also being considered for the location of an LNG export facility. Assessment of LNG options is estimated to be completed by the end of 2012. Regardless of the selected pipeline option, a minimum of five off-take connections would be built into the pipeline to allow local natural gas suppliers to obtain product to meet local community needs. These connections could be used to construct spur pipelines to serve the Fairbanks and Southcentral Alaska. The APP is in the planning process and the first gas is currently estimated to be well behind the proposed Project timeline. Furthermore, implementation of the APP is uncertain. Therefore, spur pipelines from a North Slope-to-Lower 48 or Valdez Pipeline would not meet the purpose and need of the proposed Project and would not be a reasonable alternative.
- **A pipeline from the North Slope to Fairbanks, and transport by rail car to Southcentral Alaska**. This would involve the proposed Project terminating at a new LNG conversion/production facility near Fairbanks, located near the northern reach of the Alaska Railroad (ARR). After conversion, the LNG would be transported by ARR rail car to new LNG storage and gasification facilities near Anchorage, which would have access to the existing Southcentral Alaska natural gas distribution system. Significantly, this alternative would not be logistically practicable means of moving large volumes of LNG from Fairbanks to Southcentral Alaska for 30 or more

[1] Source:http://thealaskapipelineproject.com/project_info.

years. Therefore, the pipeline and rail alternative would not be a reasonable alternative.

- **Transport by truck/trailer.** Transport by truck/trailer would involve conversion of natural gas to LNG at a new production facility on the North Slope and subsequent transport of LNG by truck/trailer via the Dalton, Elliott, and Parks highways to new LNG storage and gasification facilities in Fairbanks and Southcentral Alaska. Transshipping LNG by truck/trailer has been accomplished by use of 44-foot-long, 13,000 gallon gross capacity trailers. Each trailer has the capacity to carry LNG that when gasified would amount to approximately 1 MMscf of natural gas. Therefore approximately 500 trailers per day would be required to transport 500 MMscfd. This would require one loaded trailer leaving a North Slope LNG facility approximately every 3 minutes around the clock. Thus, this alternative would not be logistically practical or reasonable.

Pipeline Route Alternatives

Approximately 82 percent of the proposed Project route would be co-located with or would closely parallel existing pipeline or highway ROW. Co-location is desirable as a means of concentrating development within established corridors and minimizing environmental impacts. A major route alternative is defined as a generally longer segment of ROW that would follow a route different from the proposed pipeline. Major route alternatives and route variations that would be co-located with other established corridors were examined as potential alternatives to the proposed Project route. Major route alternatives and route variations identified and analyzed in the FEIS are depicted in Figure ES-3.

Major Route Alternatives

Because only one established corridor exists in the proposed Project area, only one reasonable major route alternative would be possible. A Richardson Highway route alternative would be co-located with an established highway corridor and provide for transport of natural gas to Fairbanks and Southcentral Alaska. A Parks Highway route alternative and a Richardson Highway route alternative were examined and compared in the 2009 Stand Alone Pipeline Alternatives Analysis conducted by the State of Alaska. The 753-mile-long Parks Highway Route considered in the analysis was subsequently refined to the 737-mile-long proposed Project route. The State of Alaska found that constructing a pipeline along the Richardson Highway Route would cost approximately 10 percent more than along the Parks Highway Route. The Richardson Highway Route Alternative would be longer by 92 miles (845 miles long vs. 753 miles) and would cross a greater number of streams, and two mountain ranges. As a result of the increased length, the Richardson Highway Route Alternative would impact 23 percent more wetland features (730 features vs. 593 features), 35 percent more wetland habitat (1,735 wetland acres vs. 1,288 acres), and a greater number of wetland acres of each wetland type than the Parks Highway Route Alternative that was studied in the Alternatives Analysis conducted by the State of Alaska. Under the Richardson Highway Route Alternative, the lateral pipeline from south of Eielson Air Force Base to Fairbanks would be 3 miles shorter than the Fairbanks Lateral associated with the proposed Project (32 miles long vs. 35 miles).

The route of the proposed Project is a refinement of the Parks Highway Route that was the subject of the Alternatives Analysis conducted by the State of Alaska in 2009. For the proposed Project, the Parks Highway Route was refined and shortened by an additional 16 miles, indicating further reduction in overall impacts. Based upon this analysis, the Richardson Highway Route Alternative does not appear to include features that would result in fewer environmental impacts when compared to the Parks Highway Route. Therefore, the Richardson Highway Route Alternative would not in fact present environmental advantages over the Project as proposed.

Route Variations: Route variations differ from major route alternatives in that they are identified to resolve or reduce construction impacts to localized, specific resources such as cultural resources sites, wetlands, streams, recreational lands, residences, or terrain conditions. Several route variations including the Fairbanks, Denali National Park, Curry Rail, Alaska Intertie, and Port MacKenzie Rail Extension route variations are considered and analyzed in Section 4.4.2 of the FEIS. Only the Denali National Park Route Variation is considered a reasonable alternative that would present environmental advantages over the proposed Project route. Several route variations were screened but only the Denali National Park Route Variation is considered a reasonable alternative.

Figure ES-3a: Major Route Alternatives and Minor Route Variations

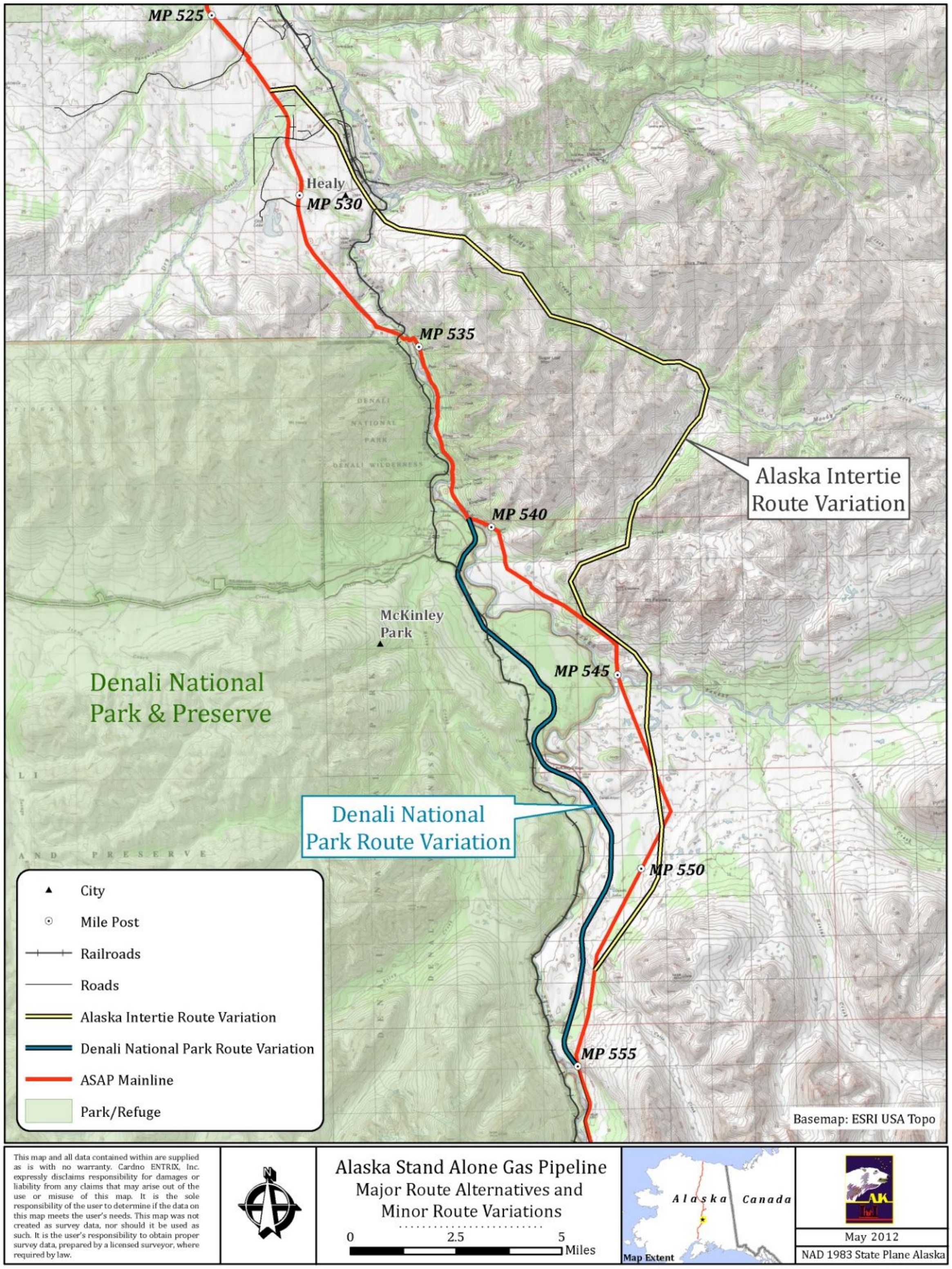
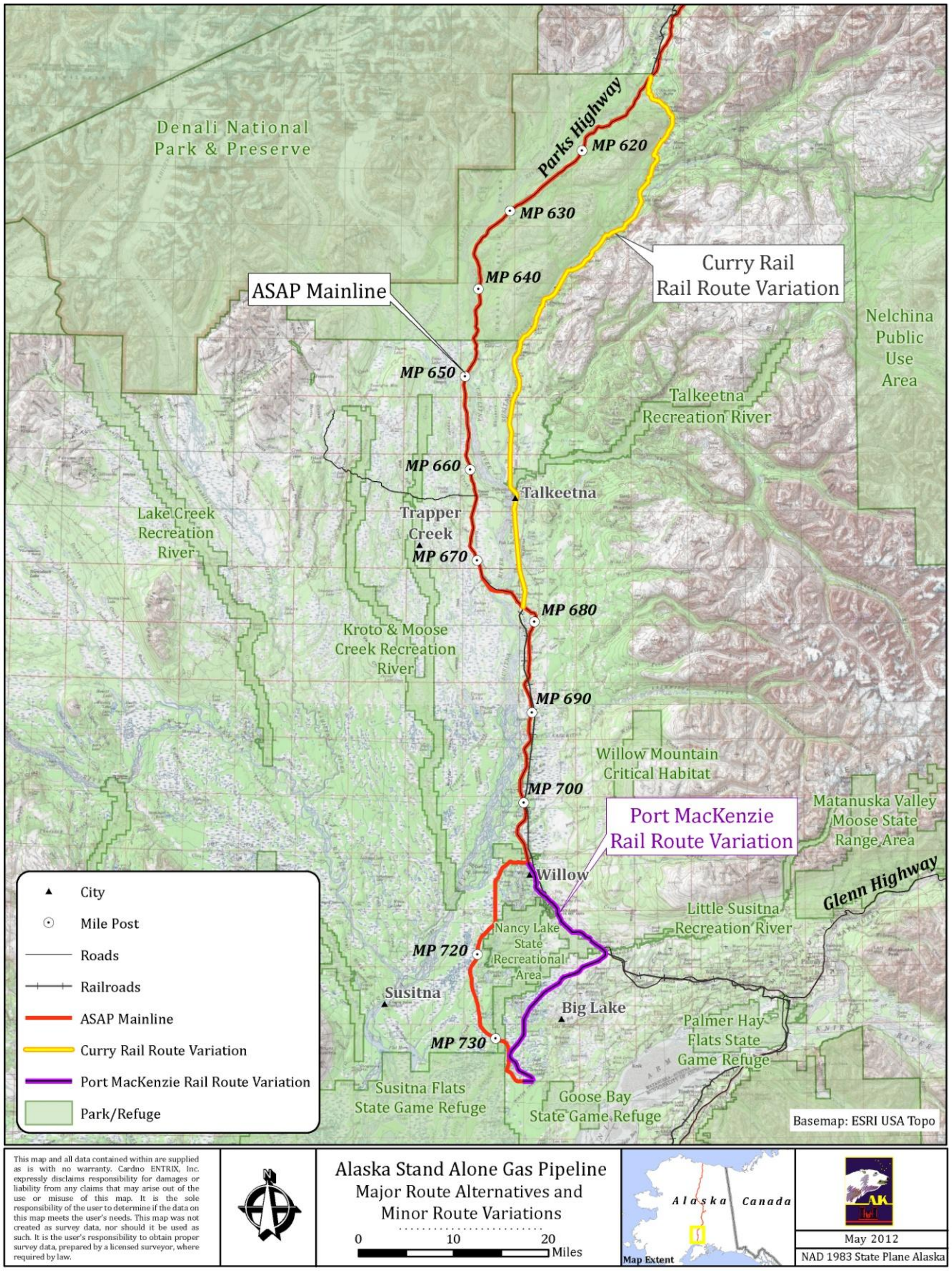


Figure ES-3b: Major Route Alternatives and Minor Route Variations



The Denali National Park Route Variation would be approximately 15.3 miles long, and would be within Denali National Park for approximately 7 miles, but would stay in the Parks Highway ROW. None of the Denali National Park and Preserve lands that would be crossed are designated wilderness areas. Currently, federal laws do not allow construction of this route variation within Denali National Park and Preserve. Federal legislation that would allow the route variation has been introduced by the Alaska congressional delegation, and is currently being considered by the U.S. Congress. If such legislation is passed into law, the National Park Service (NPS) would have authority to issue a ROW permit for a pipeline route which would result in the fewest or least severe adverse impacts upon the Park. For this reason, the description of the Denali National Park Route Variation includes the provision that the AGDC would work with the NPS to adjust and refine the proposed route variation through Denali National Park and Preserve to assure that the route or mode would result in the fewest or least severe adverse impacts upon the Park.

The Denali National Park Route Variation would be of similar length to the segment of the proposed pipeline that it would replace, and would be co-located with the Parks Highway. Should Federal legislation allow within the time constraints of the proposed Project, the Denali National Park Route Variation is a reasonable alternative that could minimize visual impacts in the area of Denali National Park and Preserve.

Aboveground Facility Site Alternatives: Aboveground facilities that would be components of the proposed Project include: a North Slope GCF; a Fairbanks gas straddle and off-take facility; one or two compressor stations; a NGL extraction facility; access roads; valves; pigging facilities; maintenance facilities; and pipe yards and camps. The general locations of these facilities are constrained by proximity, technical and logistical issues related to proposed Project construction and operations. Considering these constraints, the AGDC applied other siting criteria to determine the specific locations of the proposed aboveground facilities. These included: topography; waters, wetlands and habitats; visual resources; cultural resources; and people and communities. Based on the siting process, it is reasonable to assume that environmental impacts could be more effectively reduced by the implementation of site specific mitigation measures rather than by alternative facility sites. Applicant proposed mitigation measures have been identified in Section 5.23 of the FEIS. Accordingly, specific alternative aboveground facility sites have not been identified.

Pipeline Facility Construction

Photo: Courtesy of Michael Baker, Inc.

ENVIRONMENTAL ANALYSIS

The environmental analysis of the proposed Project describes the affected environment, direct, indirect and cumulative impacts that would result from construction and operations. The environmental analysis is organized by physical, biological and human environmental resources in Sections 5.1 through 5.20 of the FEIS. Section 5.23 describes applicant proposed mitigation measures and their effects on impacts to each affected resource

Soils and Geology

The following geomorphic processes and features would be encountered in the proposed Project area: mass wasting (gravity-driven actions such as avalanches, rock falls, slides, and slumps, as well as solifluction in cold regions); permafrost degradation/ aggradation and frost action; and seismicity. Geomorphic processes such as these must be considered in pipeline engineering, design, siting and construction due to the fact that these processes have the potential to impact pipeline stability and operations.

Permafrost and Soil Considerations: Permafrost can occur in both soils and bedrock, and is encountered in all nine ecoregions traversed by the proposed Project.

Winter construction activities are planned as a method to decrease the impact on permafrost soils in the warmer months. Temporary ice roads and ice pads would be constructed to stage, construct and transport the work force, equipment and materials along the proposed route. The depth of frozen soil would be closely inspected to prevent a breakthrough below the vegetation. When low-pressure vehicles are used, winter travel does not appear to adversely affect soil or permafrost.

As designed, the pipeline would operate at below freezing temperatures in predominately permafrost terrains to protect the thermal stability of the surrounding ground. Similarly, the pipeline would operate at above freezing temperatures in predominately thawed settings so as not to create frost bulbs around the pipe that could lead to frost heave displacement of the pipeline or adverse hydraulic impacts on drainages crossed by the pipeline. Pipeline design would use engineering controls such as insulation and strategic use of non-frost-susceptible fill to control the thermal signature of the pipeline in discontinuous permafrost.

In areas bermed because of pipe installation, 6 inches minimum of bedding thickness would be required when working in areas of frost susceptible soils. Pipe insulation would be utilized to prevent unacceptable heave or maintain frozen soils based on geothermal analysis.

Brooks Range

Photo: U.S. Fish & Wildlife Service

Seismic Zones and Fault Considerations: South of the Yukon River, the proposed Project would cross two seismic zones that trend northeast in the Ray Mountains ecoregion: the Minto Flats and Fairbanks seismic zones. The Intermontane region includes the Kobuk Ridges and Valleys, Ray Mountains, Yukon-Tanana Uplands, and the Tanana-Kuskokwim Lowlands ecoregions and has experienced 23 earthquakes greater than magnitude 5, within 50 miles of the proposed Project area. The Alaska Range Transition, with 88 earthquakes greater than magnitude 5, within 50 miles of the proposed Project area, has seen the most seismic activity since 1960, and includes the Alaska Range and Cook Inlet Basin ecoregions.

The Castle Mountain fault, which fault lies along the southern margin of the Talkeetna Mountains, is the only known active fault in the Cook Inlet Basin Ecoregion with an identified surface rupture. Both the 62-mile long eastern and 39-mile long western parts of the fault are seismically active. The fault produced light to moderate magnitude 5.7 and 4.6 earthquakes in 1983 and 1996, respectively. The most recent significant earthquake along the eastern portion of the fault was about 650 years ago, which suggests the possibility a significant earthquake (~M6) may be expected in the near future.

The Denali Fault is several hundred miles long, with movement recorded in several locations along its length. Two large earthquakes, magnitude 7.2 and 7.9, occurred on the Denali Fault in 1912 and 2002, respectively. North of the Denali fault, on the north side of the central Alaska Range, there is an active, northward-vergent fold and thrust belt called the Northern foothills fold and thrust belt. This fold and thrust belt has been active through the last 3 million years, and extends from the area near Mount McKinley (Denali) to east of the Richardson Highway.

The Healy Creek fault in the north-central Alaska Range foothills, is a major, steeply north dipping reverse fault that is defined on the east side by the Nenana River and is part of the Northern foothills fold and thrust belt. On the high terrace immediately east of the Nenana River this fault forms a prominent scarp more than 6 miles long. However, it is not clear that the fault continues across the Nenana River.

The following design approaches are currently being considered for areas of high seismic activity and/or fault zones:

- Placing the pipeline on aboveground sliding supports;
- Placing the pipeline in an aboveground berm constructed of low-strength soil;
- Placing the pipeline in an oversized ditch surrounded by low-strength crushable material or loose granular fill.

Paleontology: Fossils occur throughout Alaska and range from single-celled organisms to large vertebrates, including Mesozoic dinosaurs, marine reptiles, and Pleistocene megafauna. Paleontological evidence in Alaska varies, and with respect to the proposed Project area, can be characterized broadly. Fossilized plants of marine and terrestrial origin, as well as invertebrate and vertebrate animal specimens, have been found in the area of the proposed Project.

Alaska's Historic Preservation Act protects paleontological resources that may be encountered along the ROW. If any known or previously undiscovered paleontological resources are encountered during construction or operation related activities, the Alaska State Historic Preservation Officer and an archeologist would be contacted to determine appropriate methods for planning.

Water Resources

Water resources (surface water, groundwater and floodplains) are described under three sub regions of the proposed Project: Arctic, Interior-Yukon, and Southcentral. The proposed Project ROW would cross approximately 495 waterbodies; 75 of which have been confirmed as anadromous. The total drainage area of 9 watersheds that would be crossed by the proposed Project area is 47,983 square miles.

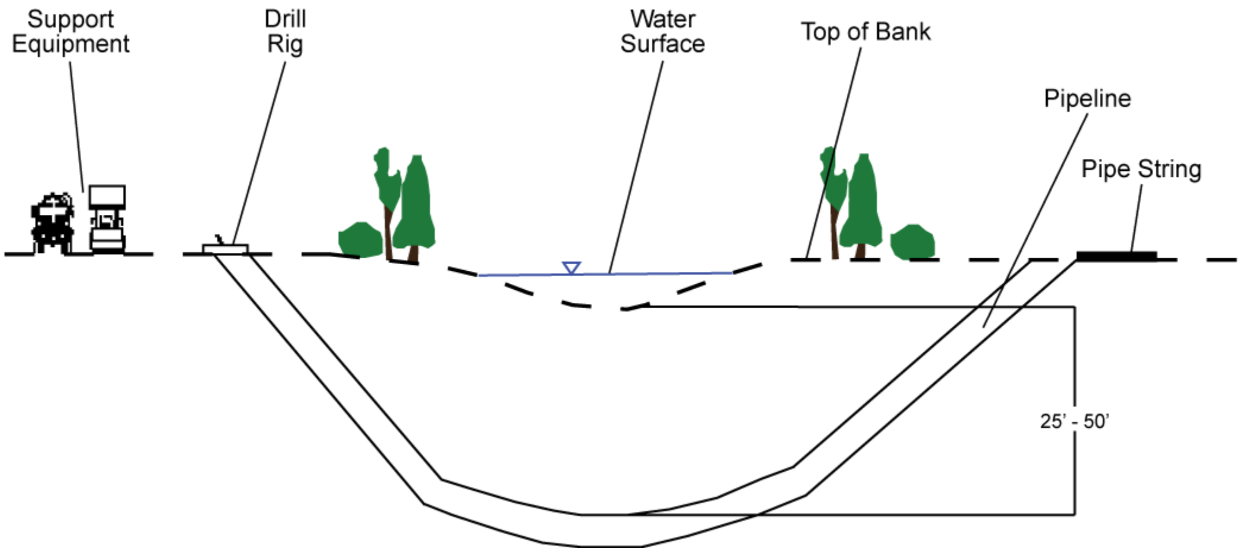
Surface Water: Surface water bodies found throughout the proposed Project area include numerous streams, rivers, ponds, and lakes. Water uses for preconstruction activities of the proposed Project include; water withdrawal from permitted lakes for the development of ice road/pads and for temporary work camps. Impacts to water resources could include altered water quality from water withdrawals including decreased oxygen concentrations, increased organic matter, turbidity and changes to pH. Proper ice road/pad development during construction activities would not adversely affect surrounding water resources. Ice bridges could form and persist across rivers and streams where ice roads were developed. Mitigation efforts would include slotting the bridged ice with equipment, but the bridged ice could melt slower than the surrounding ice and snow. Flooding could occur during spring break up naturally and from reduced stream discharge and result in increased sedimentation loads which would be temporary and localized.

Construction activities for the ROW would include clearing vegetation, grading over the centerline, and excavating a trench for pipeline installation across streams. Four stream crossing methods would be used: open-cut, open-cut isolation, horizontal directional drilling (HDD) and bridges. The HDD method is detailed in Figure ES-4. Up to four existing bridges would be used throughout the proposed Project ROW and one new pipeline suspension bridge could be constructed across the Yukon River. The open-cut method would be the most common stream crossing method used, and could potentially impact instream features by temporarily reducing water quality downstream due to increased sedimentation and turbidity from excavation within the streambed and streambanks. Permanent impacts could include changes to the stream profile and structure (bed and hyporheic zone) at crossing locations, and loss of forested riparian vegetation from construction activities and subsequent maintenance of the ROW. Impacts would be minimized by performing the majority of open-cut trench crossings in the winter, and minimizing duration of in-stream construction in the summer. Streambanks would be revegetated and stabilized with regulated seed types for non-forested vegetation establishment. Streambed scour is not expected to affect the pipeline due to burial of the pipeline five feet below the surface of streambeds. Impacts from proposed Project construction at stream crossing locations would primarily be temporary and local.

Hydrostatic testing of the pipeline would require approximately 80 MG of water to be withdrawn from permitted lakes. Release water would be discharged into permitted uplands and in settling basins in order to comply with discharge regulations. Potential impacts from the operation phase of the proposed Project include short term altered stream flow and sedimentation directly after construction events. Long term potential impacts could include altered thermal regime if the chilled pipe is a lower temperature than the ambient ground temperature. This could result in ice damming effects in the winter. The pipeline would mitigate for this by operating the pipeline at a temperature that would match the temperature of the surrounding ground to maintain the thermal regime.

Groundwater: Groundwater is found throughout most of Alaska, but is limited in the northern area of the proposed Project due to continuous permafrost. Groundwater is primarily derived from glaciers, rivers and streams, and the depth of the water table can be as shallow as a few feet to as deep as 400 feet below the surface of the ground. Groundwater is the primary source of Alaska's public drinking water systems and is suitable for agricultural, aquaculture, commercial and industrial uses with moderate to minimal treatment. Arsenic has been found to occur in groundwater within the proposed Project footprint. Contaminated sites also occur within the proposed Project area along the existing ROW of the Parks Highway. Groundwater uses would primarily occur at permanent aboveground facilities and the proposed

Figure ES-4: Cross Section of Horizontal Directional Drilling Method



Project would not be expected to adversely impact drinking water protection areas, existing groundwater availability, use or quality.

Floodplains: Floodplains provide important ecological and hydrological functions and would be avoided to the extent most practicable for development of the proposed Project. Floodplains would be recontoured to a preconstruction state as much as possible, and revegetated with native plant seeds for vegetation establishment. Impacts from proposed Project development would not be expected to adversely impact floodplains.

Terrestrial Vegetation Resources

The proposed Project would cross a diverse array of landcover types extending from the Arctic Coastal Plain to the Cook Inlet Basin in Southcentral Alaska. Nine ecoregions would be crossed by the proposed Project. Approximately 4,149 acres would be retained as permanent easement maintained in a non-forested state.

Preconstruction activities include: clearing, grubbing and grading to create an unobstructed flat working space for pipeline construction. Grading and topsoil stripping would likely destroy the plant root stock, which would delay vegetation recovery substantially. Areas that are constructed during the winter on ice pads would have considerably less impact to vegetation as grading would occur only over the centerline. Construction activities could cause temporary erosion and sedimentation impacts from heavy equipment access along the ROW, but would be re-contoured to preconstruction conditions. Sedimentation structures would be installed as needed in erosion prone areas. Proposed Project construction could propagate non-native and invasive plants through several pathways; however, would likely be limited to the area of disturbance, which would be mitigated through a Non-native Invasive Plants (NIP) Prevention Plan. Preservation of topsoil and subsoil strata during excavation of the trench would be essential for rehabilitation success. Dust created from vehicle and heavy equipment use along roadsides and material sites could alter vegetation composition. These potential impacts would be localized and temporary due to the construction sequence of the proposed Project. Impacts to vegetation would be reduced substantially from associating the proposed Project ROW with existing ROWs and infrastructure. Rehabilitation would include finish grading, re-contouring and reseeding the disturbed area with ADNR approved plant seed. The ROW area outside of the permanent ROW would be allowed to grow back to a previous vegetation cover type. Operations of the proposed Project would include mowing the vegetation in the permanent ROW to a non-forested state. Forested vegetation would be removed permanently within the permanent ROW. Proposed Project operations would not create additional impacts to vegetation communities beyond the potential for dust deposition from vehicle use at facilities and invasive plant establishment. Mitigation measures and BMPs have been identified to address impacts from fugitive dust and non-native plant invasion.

Wetland Resources

Wetland resources are found throughout the proposed Project corridor from the Beaufort Sea Coastal Plain to the Cook Inlet Basin in Southcentral Alaska. Wetland classes transected by the proposed Project are grouped into two major classifications using the National Wetlands Inventory (NWI) and hydrogeomorphic (HGM) classification system. Quantities and types of wetland resources were identified from conducting a multiyear preliminary jurisdictional determination (PJD) and field investigations verifying wetlands and uplands at field target locations throughout the length of the proposed Project ROW.

Construction of the proposed Project would affect approximately 6,099 acres of wetlands throughout its length. Three methods would be employed when constructing in wetlands: open cut with matting, open cut without matting and open cut push/pull. HDD methods would not be used for construction through wetlands. Construction through wetlands would be targeted during the winter months when possible, which would reduce impacts to soils, water quality, vegetation and wildlife use considerably. Grading would occur directly over the center line (trench line) in the winter to minimize disturbance to wetlands. The vegetative mat would be separated from the subsoil during trenching for preservation of the root stock which would be essential for rehabilitation success. Wetlands would be contoured to a preconstruction state as closely as possible and seeded with an ADNR approved plant seed mix. Non-native and invasive plant species could establish along the disturbed area of the proposed ROW from heavy equipment use. The AGDC would mitigate the spread of NIP through a robust Non-native Invasive Plant Prevention Plan developed in collaboration with appropriate state and federal agencies.

Operation of the proposed Project would include mowing 1,862 acres of wetlands in the permanent ROW to maintain a non-forested cover type. Forest vegetation would be permanently lost, but other wetlands types would persist. Fugitive dust deposition on surrounding wetlands from vehicle use at facilities and pads could impact the physical and chemical characteristics of wetland plants, soil and water. Access road development in wetlands would impact wetlands permanently by a loss of wetland acreage, and wildlife habitat. Fragmentation, dust deposition, surface impoundment or degradation, and the spread of NIP species could also potentially impact wetlands from access road development. Proposed Project impacts would be reduced substantially by co-locating the ROW with existing utility corridors.

Wildlife Resources

Wildlife resources that are not ESA listed species and that are common within or near the proposed Project area include: large and small terrestrial mammals, waterbirds, upland game birds, and landbirds. The proposed Project ROW crosses seven ADF&G Game Management Units from the Arctic Coastal Plain to the Cook Inlet in Southcentral Alaska. Moose and caribou are the primary large terrestrial animals within the proposed Project area, and numerous species of waterbirds and land birds utilize the area in the summer for breeding, nesting, molting, and rearing young.

Potential impacts to wildlife from construction of the proposed Project include: habitat loss, alteration and fragmentation, indirect and direct mortality, reduced survival and reproduction. Construction activities could produce a temporary physical and behavioral barrier for wildlife due to noise and visual effects produced from human activity. Whenever possible, construction activities would be timed to occur outside of sensitive time periods for wildlife. Winter construction activities would reduce impacts to wildlife and their habitat substantially. Road use during construction activities may cause an increase in vehicle and train collisions with wildlife due to material, equipment and personnel transport.

Operational impacts to wildlife would likely be negligible in the proposed Project area with the exception of road development. Road development could increase access to wildlife areas, resulting in an increase in harvest pressure. A plan would be developed to determine what structures should be used to prevent the public from accessing wilderness areas. Habitat loss from the permanent ROW could impact tree nesting birds (eagles, owls, hawks), that utilize forested vegetation within the proposed Project footprint. Forest vegetation would reestablish over time outside of the permanent ROW, although it would take years to decades to reach maturity, resulting in long-term forest habitat impacts.

Subsequent revegetation efforts of the ROW may not provide habitat features comparable to pre-project habitats. Fragmentation of forested wildlife habitat could result from proposed Project development, particularly in areas that are not co-located with existing ROWs. The narrow area of disturbed habitat proposed for this proposed Project would be insignificant in relation to the vast amount of surrounding habitat that is available to wildlife. The development of the proposed Project would not be expected to limit habitat for wildlife. The proposed Project would be co-located with existing ROWs as much as practicable to reduce additional impacts to wildlife.

Caribou

Photo: Bauer, Erwin & Peggy

Fish Resources

The proposed Project area extends from Prudhoe Bay in the North Slope Borough to the Matanuska-Susitna Borough near the Cook Inlet. It crosses through three major hydrologic regions: the Arctic Slope region, Interior region, and Southcentral region. The proposed Project would cross 516 streams throughout these regions. Eighty-two of the stream crossings have been confirmed to provide habitat for anadromous fish. Many of the streams that are proposed to be crossed have not been studied for fish species presence. Two types of fish are found in the waters transected by the proposed Project area: anadromous and resident species. Thirty species of fish have the potential to occur throughout some part of their lifecycle within the proposed Project area.

Water withdrawn from permitted lakes during the pre-construction phase of the proposed Project would be used for ice road/pad development and for temporary work camps. An ADF&G fish habitat permit and ADNR Temporary Water Use permit is required to prevent degradation of water quality, and adverse impacts to fish. Potential impacts to fish include: stress or mortality from low dissolved oxygen concentrations; altered fish behavior, distribution and growth resulting from water fluctuations; and reduced invertebrate productivity. These impacts would be mitigated by regulating the withdrawal rates and quantities for proposed Project construction. Ice roads constructed across streams can cause ice bridges which can dam surface flow altering fish passage and habitat use. Ice slotting would occur at ice bridge locations during spring break-up to prevent excessive flooding or damming beyond what naturally occurs.

Installation of the buried pipeline across fish-bearing streams is likely to have the greatest potential effect on fish resources from proposed Project development. Stream crossings would be constructed using four methods: open-cut, open-cut isolation, HDD, or bridge crossings. The degree of construction-related impacts to fish would depend on the type of crossing method used, the timing of construction, duration of in-stream activity, life stage and type of fish present and the mitigation measures implemented. Potential temporary impacts to fish resources that could occur during construction include: in-stream habitat alteration (substrate, water depth, flow, large wood debris, water quality, sedimentation/turbidity), and changes to the channel profile.

The wet open-cut method would likely cause the greatest temporary impacts to fish resources due to excavation within the streambed resulting in temporary increased sedimentation loads. Stream locations along the proposed ROW that freeze to the bottom, would be constructed in the winter which would reduce impacts to fish. Additional impacts could include riparian vegetation loss and stream morphology alteration of the hyporheic zone. Each subsurface stream crossing would be permitted and constructed in a manner and during a time period that would avoid or minimize potential impacts to fish. In-stream pipeline construction within each waterway crossing is anticipated to be completed in one to three days. The proposed Project includes the construction of one potential pipeline suspension bridge across the Yukon River as an option. No other pipeline bridge construction is proposed. Hydrostatic testing of the pipe would have the same potential impacts to fish as water withdrawal activities for ice roads and pads.

Proposed Project operations are not expected to adversely impact fish or their habitat beyond reducing the riparian habitat at stream crossings from regular mowing of the ROW, and potential instream habitat effects from a chilled buried pipeline. Ice damming could occur during the winter, if the buried pipe temperature is colder than the ambient ground temperature. This could alter the environment for fish resources affecting fish behavior, survival and productivity. The AGDC would mitigate for this by maintaining the temperature of the pipeline to the surrounding ambient ground temperature as much as practicable. The loss of riparian vegetation on stream banks could potentially contribute to increased erosion and instability resulting in reduced fish habitat and water quality. The AGDC would mitigate for this by maintaining riparian habitat as much as possible to prevent erosion and allow for inspection of the ROW.

Additional impacts could occur to fish resources from access road development. New access roads would require bridges or culverts to cross streams, which could result in long-term alteration of fish habitat. Implementing stream simulation culverts under all roads in tributary streams would alleviate many impacts to fish from geomorphologic alteration. Long term impacts could include a loss of riparian vegetation at stream crossings, and sedimentation from road use. Dust and gravel could be deposited in the stream channel on either side of the crossing. Run-off could potentially transport contaminants from the road affecting water quality in the stream. To mitigate potential impacts to fish and their habitats, additional erosion control plans, sedimentation and rehabilitation plans would be developed and approved by agency staff with associated permits for proposed Project implementation.

Yukon River Suspension Bridge Simulation

Photo: The AGDC

Marine Mammals

Eight species of marine mammals that are not listed under the Endangered Species Act (ESA) could potentially occur near or within the proposed Project area. These include gray whale, beluga whale, killer whale, harbor seal, minke whale, harbor porpoise, Dall's porpoise and Pacific white-sided dolphin.

The Port of Seward (POS) would receive the majority of the shipments for equipment and pipeline material needed for proposed Project construction. The Port of Anchorage (POA) may be utilized to supplement shipments to the POS; however, this has not been determined to date. West Dock Port is located in the Beaufort Sea, which would receive shipments for materials to construct the pipeline and facilities at the northern end of the proposed Project footprint.

Vessel activity would be the only Project-related activity that would occur in the marine environment. Project-related vessel activity would occur prior to or during the construction phase. Disturbance to marine mammals from vessel activity could be in the form of vessel noise, vessel movement, or a potential collision with a marine mammal. Noise produced from the additional vessel activity along existing transportation routes would be considered relatively minimal, temporary, and localized. Vessel activity proposed for the proposed Project would not significantly increase the volume of marine traffic in the proposed Project area or along existing transportation routes. Current information indicates that vessel collisions with whales are not a significant source of injury or mortality. Marine mammals could be displaced temporarily if they were located in the vicinity of vessel activity. However, they would likely be habituated to regular vessel noise and movement. Masking could occur temporarily to species that communicate at low frequency sounds similar to vessel noise produced, although this would be a rare occurrence. Finally, routine vessel operations could result in small fuel leaks and lubricants that are toxic to marine mammals. This would be unlikely to adversely impact marine mammals due to the relatively minimal vessel activity expected for the proposed Project. As a result, marine mammals are not expected to be adversely impacted by vessel activity from the proposed Project.

Killer Whale Pod

Photo: Hosking

Threatened and Endangered Species

Species listed under the ESA as endangered, threatened, proposed for listing, and candidates for listing that could occur in the proposed Project area include 10 marine mammals and four bird species. Critical habitat for three ESA-listed species occurs within or near the proposed Project area, namely the Cook Inlet beluga whale, polar bear and Southwest stock of Northern sea otter. Endangered species include the bowhead whale, Cook Inlet beluga whale, fin whale, humpback whale, Steller sea lion, and Eskimo Curlew. The Eskimo Curlew is thought to be extinct since the last sighting was in 1962. Threatened species include the polar bear, spectacled and Steller's eiders, and Southwest stock of Northern sea otter. Species proposed for listing as threatened are the bearded seal and ringed seal. Candidate species are the Pacific walrus and Yellow-billed loon.

Vessel activity would be required to deliver materials and supplies to the POS, West Dock and potentially the POA. These are the only proposed Project activities expected to occur in the marine environment, and would occur over a 2-year construction period. Potential impacts from vessel activity include: disturbance to seals and whales from vessel noise and movement. Temporary displacement of natural behavior could occur in the vicinity of vessels. However, natural behavior would be expected to resume quickly. Masking effects from vessel noise also could occur temporarily, making it difficult for marine mammals to communicate in their environment. Vessel activity is common at these port locations and shipping lanes, and marine mammals would likely be habituated. Impacts from vessel activity for proposed Project construction would be unlikely to adversely affect ESA and candidate species.

Construction and operation of the GCF and the pipeline on the North Slope may cause disturbance to a few polar bears and potentially their prey (ringed and bearded seal) from increased vessel activity. The proposed Project would not likely adversely modify or destroy polar bear critical habitat. The proposed Project area has not been known to inhabit any polar bear dens and the area does not possess preferred den habitat characteristics. No polar bear dens are likely to be disturbed during construction or operation of the GCF or the pipeline. Compliance with regulations pertaining to polar bears for North Slope oil and gas operations would minimize potential impacts to the polar bear and its critical habitat.

The spectacled eider breeding habitat could be disturbed for the construction of the proposed Project due to the potential loss of nesting and breeding habitat. Habitat loss is not likely to adversely affect spectacled eiders since nesting habitat for spectacled eiders is not limiting on the North Slope of Alaska. Potential disturbance to any nesting spectacled eiders in the proposed Project area would be minimized through construction timing. Additional impacts to spectacled eiders could include collisions with structures, increasing mortality, noise disturbance and increased predation on nests. The timing of construction activities during winter and coordination with the U.S. Fish and Wildlife Service (USFWS) regarding lighting of vessels and structures would minimize impacts to spectacled eiders substantially as they use the area only in the summer.

Steller's eiders are not likely to be adversely affected from the proposed Project activities because their breeding areas are primarily west of the proposed Project area. No critical habitat for Steller's eiders has been designated on the ACP. The proposed Project is not anticipated to disturb nesting Steller's eiders or their nesting habitat. Similar impacts to spectacled eiders could occur to nesting Yellow-billed loons due to the overlap of nesting areas with proposed Project development. Construction activities for the portion of the pipeline from the GCF to MP 70 could disturb a small number of nesting Yellow-billed loons; although most construction would occur during the winter when Yellow-billed loons are not present on the North Slope. The proposed Project would be unlikely to adversely affect Yellow-billed loons.

Land Use

The proposed Project ROW would impact lands owned by the federal government and managed by the BLM, Department of Defense (DOD; Clear AFS), and the NPS. The Denali National Park Route Variation would intersect the Denali National Park and Preserve, which is managed by the NPS. The State of Alaska, University of Alaska, AHTNA, Inc. and the Toghotthele Corporation have selected federally-owned lands within the proposed Project ROW for their future ownership. The State of Alaska owns the greatest number of parcels within the proposed ROW. Lands owned by the State of Alaska are managed by the Alaska Department of Natural Resources (ADNR). With the exception of the Denali NPP and 6(f) lands, all other lands have applicable land use plans or documents that provide for utility crossings. As a result, the proposed Project would be compatible with these plans. The proposed Project ROW would cross railroads, utilities (including the Trans-Alaska Pipeline System [TAPS]), trails, driveways, and local and arterial roads. Potential effects include disruption to traffic flow and utility service. Effects to agricultural lands would be minimal, with only 0.1 percent of the construction area affected by the proposed Project ROW utilized for agriculture. The proposed Project has the potential to affect developed land by exposing residences or commercial/industrial buildings located near the proposed Project ROW and aboveground facilities to dust and noise primarily during proposed Project construction.

Temporary effects could occur to established trails (section-line easements, R.S. 2477 trails and 17(b) easements) during proposed Project construction and maintenance. These effects would be minimized by adhering to the stipulations contained in the ROW permit granted to the applicant by the State (Appendix M), which states the proposed Project may not obstruct a public access easement or otherwise render it incapable of reasonable use for the purposes for which it was reserved. The proposed Project would therefore not interfere with the use of section-line easements, R.S. 2477, and 17(b) easements. Effects on lands acquired by use of grants provided through the Land and Water Conservation Act are described in Sections 5.9 and 5.10 of the FEIS.

Coldfoot, Alaska Airstrip (community along proposed pipeline route)

Photo: Courtesy of Michael Baker, Inc.

Recreation

Although the proposed pipeline alignment was designed to avoid recreation areas to the greatest extent practicable, the mainline pipeline would either cross or be located near (i.e., within less than 1 mile) a number of key recreation features. These include BLM-managed recreation sites in the Dalton Highway Corridor Management Area, the East Fork Chulitna River Campground, Denali State Park, Montana Creek State Recreation Area, Arctic National Wildlife Refuge, Denali NPP, Nancy Lakes State Recreation Area, Tanana Valley State Forest, Susitna Flats State Game Refuge, Minto Flats State Game Refuge, Willow Creek State Recreation Area, Iditarod National Historic Trail, and the Little Susitna Recreation River. In addition, both public and private lands along the mainline route that are outside designated recreation areas are commonly subject to dispersed recreation, including trail-oriented activities.

During construction, the proposed Project could result in short-term adverse effects on tourism and recreation, primarily attributed to a general decline in recreation quality (e.g., visual from construction activities and the creation or widening of the ROW, construction noise, increase human presence from the construction workforce, and increased hauling of materials and workforce traffic), competition for use of some recreational areas and local public services, and restricted access in proximity to the pipeline route during construction.

Project operations including the mowing and maintenance of vegetation resources along the ROW would likely not affect recreation activities or the quality of recreation opportunities in proximity to the pipeline route. However, while the pipeline would be located underground, there would be restrictions to access in some areas along the proposed ROW, accomplished by the use of large boulders, berms, and/or fencing. Consequently, there could be an adverse impact on general recreation access and trail planning along the pipeline corridor over the long term, although all existing public access points would be retained. While no new public vehicular access routes are required for proposed Project operations, there could be opportunities to include multi-use paths in the proposed Project design to address issues raised during public scoping; this would be a recreation benefit to the region. As a self-contained underground facility, there also would be no effects from pipeline operations that would compromise the recreational quality of the region. Overall, there would be minor long-term adverse effects on tourism or recreation once construction is completed.

Visual Resources

Short-term visual impacts associated with construction would occur from clearing and removal of existing vegetation in the ROW, exposure of bare soils, earthwork, trenching, and machinery and pipe storage. Short-term visual impacts would be greater during construction and until re-vegetation occurs than during operations and maintenance.

Visual impacts from construction of the Denali National Park Route Variation are expected to be in the short-term moderate to high due to the sensitivity of viewers, particularly during the visitor season from May to mid-September. Construction of the pipeline would be visible from the Parks Highway, eastern Park lands, and tourist facilities near the Park entrance, and an above-ground segment of the pipeline would be located near the Park entrance on the pedestrian/bicycle bridge over the Nenana River.

Long-term impacts during operations would be associated with the following: maintenance of access along the ROW; various landform changes including earthwork and rock formation alteration; pipeline markers; and new aboveground structures located along the route such as compressor stations, mainline valves, pig launchers/receivers, and a straddle and off-take facility. During operations, the majority of the pipeline route would be located underground within the Parks Highway travel corridor, in which disturbed ground would appear similar to existing conditions following re-vegetation, resulting in low long-term impacts. The segment of the pipeline at the northern Nenana River crossing would be beneath the pedestrian/bicycle bridge and would only be visible to travelers on the Nenana River, not those on the Parks Highway or on the pedestrian/bicycle bridge.

Typical Pipeline Worker Camp

Photo: Courtesy of Michael Baker, Inc.

Socioeconomics

The proposed Project could create up to 9,500 temporary jobs in Alaska over the 2016–2019 period, while the highest number of workers to be on site at any given time during this period is 6,400 temporary employees. Non-resident construction workers would temporarily increase the population in the proposed Project area, which may be particularly noticeable in low population areas of the Yukon Koyukuk Census Area, Denali and North Slope boroughs. Given the remoteness of the areas traversed by the proposed Project, it is anticipated that most of the construction workers would live in work camps, thus minimizing the impacts on housing along the mainline, and mobilize and demobilize to these camps primarily using air transportation. To the extent that the workforce stayed in hotels and RV parks, it would result in an increase in local bed tax revenues.

Permanent employment during operation would total between 50 and 75 jobs each year over the life of the proposed Project. It is estimated that the GCF and Prudhoe Bay Operations and Maintenance (O&M) facility would employ a total of 10 people that would be housed in Prudhoe Bay on a rotation basis. Ten additional Wasilla O&M facility employees would be required. The AGDC has not yet determined the personnel requirements for the compressor stations or straddle and off-take facility. The minimal size and distribution of these workforces should result in no impacts to the availability of local housing and no long-term impacts to housing values.

Once operational, the proposed Project is projected to have a positive impact by generating annual local property tax revenues, including $23.1 million for the mainline, $1.9 million for the Fairbanks Lateral, $44.2 million for the GCF, as well as additional state property tax revenues for the compressor stations, straddle/off-take facilities, and the Cook Inlet NGLEP facility, and other proposed Project facilities. The proposed Project would also result in the generation of $154 to $309 million annually in natural gas production tax revenues, $24 to $48 million annually in oil and gas corporate tax revenues, and $79.4 million in royalties for the state.

Environmental Justice

It is expected that minority and low-income communities would be positively affected by the proposed Project through the creation of jobs, as well as income- and tax-effects. Some adverse quality of life effects are anticipated on communities adjacent to the proposed Project during the construction phase due to increased traffic and noise, but those adverse effects would be expected to be minor to moderate, of a temporary nature, and not concentrated in low income or minority areas. Overall, environmental justice effects on low-income and minority populations that would result from the proposed Project would be negligible or minor.

Cultural Resources

The pipeline ROW would encounter 37 Alaska Heritage Resource Survey sites and 705 sites are within 1 mile of the ROW. Direct effects to cultural resources within the ROW from ongoing or proposed activities could include physical destruction of or damage to all or part of the resource, removal of the resource from its original location, change of the character of the resource's use or of physical features within the resource's setting that contribute to its historic significance, change in access to traditional use sites by traditional users, or loss of cultural identity with a resource. Indirect effects could be characterized within a 1-mile radius of the ROW and include: vibration, noise, or atmospheric elements; neglect of a property that causes its deterioration; transfer, lease, or sale out of Federal ownership without proper restrictions; vulnerability to erosion; and increased access to and proximity of proposed Project components to culturally sensitive areas.

Subsistence

Subsistence use impacts common to the proposed Project would include direct and indirect effects on subsistence use areas, user access, resource availability, and competition in those areas. The magnitude of impacts to subsistence would vary, however. Communities that are located along the proposed ROW or whose use areas are bisected by the proposed Project would likely experience greater impacts compared to those communities located further away or which only have a small portion of their use areas intersected by the proposed Project. Construction related activities resulting from the development of the proposed Project would have both direct and indirect effects on subsistence resources, use areas, and subsistence users in terms of availability, access, and competition, as well as hunter responses and effects on culturally significant activities. Where increased employment and workforce development are concerned, subsistence users might have less time available for subsistence activities due to employment commitments and might travel less to traditional places. Furthermore, a decline in the consumption of traditional foods would result in increased cost for obtaining substitute foods. Employment would however provide the benefit of increased income which residents can in turn use to purchase equipment and supplies needed to participate in subsistence activities.

Public Health

Several public health impacts could occur during both the 2.5 year construction and 30 year operations phases. Impacts could occur to water and sanitation, health infrastructure and delivery, food, nutrition and subsistence, and social determinants of health. Other negative impacts could entail accidents/injuries, an unhealthy degree of exposure to hazardous materials, outbreak of infectious diseases (perhaps transmitted by pipeline construction workers), and an increase in non-communicable and chronic diseases. Using the rating system in the State of Alaska Health Impact Assessment Toolkit[2], nearly all of the potential impacts would be described as "low." The possibility of fatal and nonfatal injuries to members of the general public from incremental road and railroad traffic associated with pipeline construction and operation are scored "medium" using the established rating scheme. Although the health effects could be severe for those impacted by injury associated with the proposed Project, quantitative estimates of the number of persons likely to be injured are quite low. Adverse impacts on social determinants of health could arise from anxieties/concerns related to possible loss or lowering of lifestyle quality and fears about accidents/fires/explosions that could occur as a result of leaks from the pipeline during the operations phase.

Assuming that a gas distribution network in Fairbanks would be established, the largest potential health impact attributable to the proposed Project would occur during the operations phase. Natural gas emits fewer pounds of pollutants, particularly fine particulates, than wood or other fossil fuels that are currently being utilized for heating (e.g., coal, oil, and wood). Substitution of natural gas for other fuels presently used for heating would reduce fine particulate emissions in Fairbanks substantially, particularly in winter months when heaters are used extensively and air inversions are frequent. Existing concentrations of fine particulates, even at levels below air quality standards, have been proven to result in increased morbidity and mortality. Fairbanks is presently a non-attainment area for fine particulates. Thus, the potential public health benefits of readily available natural gas for heating in Fairbanks would be substantial. Natural gas supplied by the pipeline is estimated to be less expensive than other fuels, so there would be positive economic benefits as well. The analysis presented in the DEIS did not address the possibility of substitution of

[2] Available at http://www.epi.alaska.gov/hia/.

natural gas for gasoline or diesel motor fuel, which if realized would add to the stated benefits.

Various mitigation measures are included in State ROW lease stipulations and the proposed Project plan of development would minimize effects on public health. Additionally, an active health outreach program for pipeline construction workers, including free vaccinations for influenza and hepatitis A and B, is recommended.

Air Quality

Even with mitigation, the construction and operation of the proposed Project would generate GHG emissions and incrementally contribute to climate change. However, when proposed Project emissions are viewed in combination with global emissions levels that are contributing to the existing cumulative impact on global climate change, the incremental contribution of GHG emissions would be collectively small.

The natural gas and liquids transported by the proposed Project will be used for several purposes. One major benefit of the ASAP natural gas will be reduced emissions of various pollutants (e.g., particulates) in the Fairbanks area and related favorable effects on public health. But along with reduced particulate emissions, there will be reduced greenhouse gas emissions because to the extent that ASAP natural gas substitutes for other, more polluting energy sources (e.g., oil, coal, or wood) there will be a net reduction of greenhouse gas emissions. Even if it is argued that some of the ASAP natural gas is used to support increased energy demand, if the increased demand would otherwise have been met by another fossil fuel, then it is still true that the total greenhouse gas emissions would be lower.

Noise

Construction noise levels would fluctuate depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near ambient levels. In addition, construction-related sound levels experienced by a noise sensitive receptor in the vicinity of construction activity would vary by distance. Ground-borne vibration would also occur in the immediate vicinity of construction activities, particularly if rock drilling, pile driving, or blasting is required. Noise levels from the industrial equipment at the proposed gas conditioning facility and compressor stations would be approximately 85 to 95 dBA at 50 feet.

Navigation Resources

The proposed pipeline would be underground at stream crossings except for four bridge crossings. Three bridge crossings would use existing bridges and one new pipeline bridge could be built across the Yukon River as an option. Stream crossings employing open cut methods would be completed in one to three days and would be expected to result in short-term disturbances to navigability. No impacts to navigation would be expected from operation and maintenance of the proposed Project. The pipeline would meet or exceed DOT standards (49 CFR 192.327) and would be buried below the ground surface at the depth required for safe crossing of waterbodies or installed on bridges designed and constructed in compliance with Federal and state regulations, standards, and specifications for crossings of navigable waterways.

Reliability and Safety

The U.S. Department of Transportation (USDOT) pipeline standards published in 49 CFR 190 to 199 specifically address natural gas pipeline safety issues and are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The pipeline and aboveground facilities associated with the proposed Project must be designed, constructed, operated, and maintained in accordance with USDOT pipeline standards.

Furthermore, the State ROW lease for the proposed Project not only grants the AGDC a gas pipeline corridor for construction of the proposed Project, but also contains a comprehensive sequence of stipulations that will direct all aspects of the pipeline design, construction, and operation in conjunction with applicable USDOT pipeline regulations.

The Pipeline Safety Improvement Act of 2002 requires operators to develop and follow a written integrity management program that addresses the risks on each transmission pipeline segment which applies to all high consequence areas (HCA). Specifically, the law establishes an integrity management program which applies to all HCA – locations where a gas pipeline accident could do considerable harm to people and their property. The proposed Project contains 15 miles of identified HCAs.

In addition, USDOT regulations require that each pipeline operator establishes an emergency plan that includes procedures to: minimize hazards in a natural gas pipeline emergency; establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency; and coordinate mutual assistance.

The AGDC would also develop a safety plan and an O&M plan that would outline safety measures to be implemented during normal and abnormal Project operation. The AGDC would conduct a public education program that would include information on the "One-Call" program (which provides preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts), hazards associated with the unintended release of natural gas, unintended release indicators, and reporting procedures.

The number of significant incidents over the more than 300,000 miles of natural gas transmission lines that exists nationwide indicates the risk is low for an incident at any given location. The operation of the proposed Project would represent only a slight increase in risk to the nearby public.

Design, construction and operations elements that would be integrated into the proposed Project would provide a level of security from terrorism threats. These elements would include buried construction of the pipeline, locked security fencing surrounding aboveground facilities, regular air and ground inspection of the pipeline route, and regular visitation to aboveground facilities by operations and maintenance crews.

Additionally, all practicable steps would be taken to protect the pipeline from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads. During the design phase, the AGDC would address specific details such as pipe wall thicknesses as well as grade and design factors for road crossings, river crossings, bridge crossings, railroad crossings, TAPS crossings, populated areas, and major geologic fault locations. The integrity of this design approach is ensured through the proposed Project quality assurance plans and operational safety and integrity management plans.

In the event of a pipeline rupture, the leak detection system would close the pipeline isolation valves and the escaping gas would contain the equivalent of approximately 1,745 barrels (bbls) of propane and 164 bbls of butane 80 percent / pentane 20 percent. Any release would be almost entirely NGL vapor. Winter temperatures could cause the butane and pentane components to initially remain in a liquid state. However, if any liquids formed, much of the volume would quickly evaporate due to the volatile nature of NGLs. The consequences of an accidental spill of NGLs as a result of a pipeline rupture could include fire and/or explosion of NGL vapors. Potential spill impacts are likely to be short-term and low magnitude due to the volatility of NGL components. However, a small portion of the NGLs may not easily vaporize but may instead remain to potentially migrate through the soils and enter the groundwater if spill cleanup procedures were not implemented.

Trench Placement with Sideboom Installation

Photo: Courtesy of Michael Baker, Inc.

Mitigation Measures

Applicant proposed mitigation measures that would reduce adverse impacts to the physical, biological and human environment are identified and analyzed in Section 5.23 of the FEIS.

Cumulative Effects

The analysis of cumulative effects considers the potential impacts of the proposed Project and connected actions combined with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the proposed Project area. This assessment includes consideration of the existing pipelines, electrical transmission lines, and roadways, as well as other linear projects that are under construction, planned, proposed, or reasonably foreseeable in the vicinity of the proposed route. The analysis also includes existing and likely energy development projects.

Existing and Proposed Projects

Existing and proposed oil and gas and energy generation projects include the existing TAPS constructed in 1977, the proposed Point Thomson Gas Pipeline – an exploration, production and pipeline system on the North Slope, and the proposed

APP – a natural gas pipeline that would extend from the North Slope to northern Alberta, Canada or to Valdez, Alaska.

Existing and proposed North Slope facilities include the Prudhoe Bay GCF, and the possible construction of a facility to produce LNG for delivery to Fairbanks by truck.

The proposed Project would provide utility-grade natural gas to the existing ENSTAR pipeline distribution system, replacing or supplementing natural gas supplies currently obtained from Cook Inlet gas fields. The ENSTAR distribution system is approximately 3,650 miles long and serves 350,000 direct customers.

The proposed Project would be located in close proximity to an extensive transportation and utility system. Highways are continually being repaired, replaced, or upgraded, and these projects are also considered in Section 5.20. Improvements to existing public roads would not be required in association with the proposed Project. As a result of the anticipated increase in use, airports that would be used to support construction of the proposed Project may require upgrades to improve runways, lighting, communications, or navigational aids. The proposed Project would not require improvements to the ARR or to exiting port and dock facilities.

In addition, existing high voltage transmission lines would be periodically upgraded and additional parallel lines constructed to enhance the long-term reliability of the entire electrical system.

Finally, Fort Wainwright, Joint Base Elmendorf-Richardson, and Clear Air Force Base are currently proposing to perform infrastructure improvements and base upkeep activities that could coincide with construction of the proposed Project.

Regarding energy, renewable energy generation projects and new discoveries of economic natural gas resources in the Cook Inlet area could have a cumulative effect on energy supply in the region. Future renewable energy projects include wind power (e.g., the Eva Creek Wind Farm near Healy, the Fire Island Wind Farm at Anchorage, and a wind farm at Nikiski) and hydropower (e.g., Susitna, Chakachamna, and Glacier Fork projects). In addition, if operable, the Healy Clean Coal Project could contribute electrical energy to the utilities connected to the Railbelt transmission system. Renewable energy projects as well as energy conservation measures would likely occur in the future regardless of the proposed Project.

A long-term, stable supply of natural gas provided to Fairbanks by the proposed Project would likely result in development of a Fairbanks natural gas distribution system. This would include local distribution pipelines and possibly new facilities that would compress natural gas for distribution by storage tanks. Conversion or retrofit of power generation and heating facilities to allow for burning of natural gas could also take place. Also reasonably forseeable are future commercial and industrial projects that could utilize the 130 MMscfd of natural gas that the proposed Project would provide.

The proposed Accelergy/Tyonek Coal to Liquids (CTL) project would produce aviation fuel, gasoline, and diesel for military and industrial use, and would generate electricity with waste heat. A 12-inch-diameter 58-mile long buried steel pipeline from the end of the Beluga Pipeline to the Tyonek area would be required in order to transport natural gas from the proposed Project to Tyonek for use in the CTL process.

Another potential use scenario for use of the 130 MMscfd of natural gas that the proposed Project would provide is conveying natural gas from the southern terminus of the proposed Project to Nikiski for conversion to LNG and subsequent export by ship. Other potential future industrial gas users include the Donlin Creek Mine project, which plans to draw an additional 25 MMscfd of natural gas from unspecified sources at Cook Inlet by 2017, and a natural gas to liquids facility in the Cook Inlet area that would produce synthetic diesel and gasoline fuels from natural gas.

Cumulative Effects to Resources

Soils and Geology

Proposed Project-related effects to soils and geology would be mitigated with measures identified during the Project's final design phase such as the implementation of construction BMPs. The effects from connected actions and other reasonably foreseeable projects would also be identified to reduce cumulative effects. Except for competition for scarce gravel resources, the potential for substantial negative cumulative effects is low. There could be a potential cumulative effect to paleontological resources, but standard permit provisions should avoid damage to these resources associated with the proposed Project, connected actions, and other reasonably foreseeable actions.

Water Resources and Wetlands

Cumulative effects to waterbodies would be small due to the existing processes for issuing temporary use permits for construction and for water rights needed for permanent facilities.

Approximately 6,099 acres of wetlands would be temporarily impacted by the proposed Project between the North Slope and the Cook Inlet area. An additional unquantified disturbance for the conceptual development and operation of a pipeline, fractionating facility, tank farm and marine terminal at Nikiski would be disturbed during construction of this connected action. Except for wetlands within the footprint of permanent facilities, most disturbed wetlands would be expected to retain their functions after construction is completed. New disturbances to wetlands from maintenance of highways, TAPS, and ARR would not be expected. Construction of the APP between the North Slope and MP 405 could double the cumulative effect to wetlands.

Biological Resources

Negative long-term cumulative effects on vegetation or wildlife habitats would be minimal due to the largely temporary site-specific nature of the direct and indirect effects of the proposed Project on vegetation and wildlife and fish habitats.

If activities associated with reasonably foreseeable projects were to occur during a similar time period as the proposed Project, there may be a cumulative mortality of aquatic- and terrestrial- species individuals, but overall, a negative cumulative population-level effect would be minimal.

Increased vessel traffic could cause a cumulative effect of marine activity. Most of this impact would affect aquatic and marine resources – including mammals – due to marine activities during construction and operation of the proposed Project and connected action combined with other reasonably foreseeable actions. However, cumulative negative effects to federal- or state- listed species would not be expected.

Land Use

Reasonably foreseeable future projects that would be constructed within existing transportation and utility corridors generally would be consistent with existing land use planning and would therefore be assumed to have minimal effects on land use.

Anchorage, Alaska
(city near the terminus of the proposed pipeline route)

Photo: Courtesy of Alaska Division of Community and Regional Affairs

For example, there would be a short-term negative cumulative effect on recreational opportunity and activity in the proposed Project area due to both construction activity and increased competition for recreation resources from construction workers assigned to the reasonably foreseeable projects associated with the proposed Project.

New roads and the cleared ROW through forested areas could increase unauthorized off-road vehicle use and result in ground disturbance, damage to vegetation, and greater potential for soil erosion. However, overall roadway improvement and maintenance projects are not expected to result in an adverse effect even when combined with the proposed Project. It is unlikely but possible that coinciding construction or maintenance schedules could prevent traffic flow on the Parks or Dalton Highways.

Visual Resources

Since it would be located within an existing transportation and utility corridor, the overall cumulative effect of the proposed Project on the visual resources in the proposed Project area when combined with TAPS, APP, highways, and ARR would be minimal.

Socioeconomics

Potential beneficial effects as result of the proposed Project and connected actions could be expanded when coupled with reasonably foreseeable future actions. These benefits include jobs, tax revenues, and a long-term stable supply of natural gas for electrical generation, home heating and industrial activities. As the mix of energy sources in the Railbelt and rural Alaska alters, there could be incremental change in the overall cost of energy. Because of the small size of the Alaska population, in-state demand is correspondingly small. This also leaves only a small base to cover the initial investment and operating costs for each new energy source. The addition of new non-oil and gas energy sources to the Railbelt area would increase the quantity of natural gas available for in-state industrial use and for export.

Potential adverse effects to quality of life from noise, traffic delay, and increased competition from construction workers are expected to be short-term in duration.

Cultural and Historic Resources

Because of co-location with existing disturbed ROWs for substantial distances along the proposed Project ROW, as well as avoidance of potentially eligible properties wherever possible, the incremental contribution to cumulative effects from the proposed Project to cultural and historic resources in the proposed Project area would be expected to be minimal.

Subsistence

In conjunction with other reasonably foreseeable and future projects within subsistence areas, the proposed Project would result in cumulative temporary and permanent disruption of subsistence activities. Associated with this impact would be the potential decrease in available harvest resulting from temporary disturbance to wildlife, fisheries, and their habitat. The scale of this disruption would depend on the scale of the other projects.

Public Health

Measured against all cumulative health effects from state and federal programs, other oil and gas activities, and other industrial developments, the direct incremental impacts of the proposed Project on public health would not likely be large. An important positive cumulative effect of the proposed action is that residents in the Fairbanks region would benefit in health terms as a result of improved regional air quality resulting from the proposed Project and a Fairbanks gas distribution system. These benefits are described in detail in Section 5.15 of the FEIS. Adoption of the No Action Alternative will eliminate the incremental direct impacts but also forgo the cumulative benefit to health from improved regional air quality around Fairbanks. Direct and cumulative effects on public health associated with the proposed action are discussed in Section 5.15.

Air Resources

Even with mitigation, the proposed Project would generate GHG emissions and incrementally contribute to climate change. However, when proposed Project emissions are viewed in combination with global emissions levels that are contributing to the existing cumulative impact on global climate change, the incremental contribution of GHG emissions would be collectively small.

Noise

Due to the short term nature of proposed Project construction and the absence of sensitive noise receptors near work areas, only short-term and transitory cumulative noise effects on humans and wildlife would occur.

Navigation

Disruption of existing vessel traffic at the POS or at West Dock would be unlikely. There would be a long-term increase in vessel traffic in Cook Inlet associated with NGL processing and distribution, and LNG export from Nikiski. When combined with current Cook Inlet vessel traffic and future port improvement activities, fishing, and marine scientific research, proposed Project navigation activity could result in a cumulative increase in vessel congestion and modification to traffic patterns.

Reliability and Safety

There would be potential cumulative effects to safety and reliability with the convergence of the proposed Project, TAPS, highway use and maintenance, and the ARR. It would be expected that final design for the proposed Project would include written agreements that the proposed construction activities, operating conditions, and maintenance requirements would not cause undue risk to existing transportation and utility systems. Accordingly, no negative cumulative effects to TAPS, highways, or the ARR would be expected.

1.0 PURPOSE AND NEED

The Alaska District, U.S. Army Corps of Engineers (USACE) and six cooperating agencies — the Bureau of Land Management (BLM), U.S. Environmental Protection Agency (EPA), National Park Service (NPS), Alaska Department of Natural Resources (ADNR), State Pipeline Coordinator's Office (SPCO), U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA), and the U.S. Coast Guard (USCG) — initiated the National Environmental Policy Act (NEPA) process for the Alaska Stand Alone Gas Pipeline (ASAP) Project on December 4, 2009 by issuing a Notice of Intent (NOI) to Prepare an Environmental Impact Statement (EIS). A Draft EIS was issued on January 20, 2012. This final EIS examines the Alaska Gasline Development Corporation's (AGDC, the applicant) plan to construct a 24-inch diameter, 737-mile long, high pressure natural gas pipeline, referred to henceforth as the proposed Project (Figure 1.0-1), and transport a stable and reliable supply of natural gas and natural gas liquids (NGLs) from near Deadhorse on Alaska's North Slope to Fairbanks and the Cook Inlet area. This EIS examines the potential impacts of construction and operation of the proposed pipeline, and evaluates a range of alternatives, consistent with applicable law, by which to accomplish the purpose and need of the proposed action while avoiding or minimizing adverse impacts. The USACE and cooperating agencies have joined in this effort in order to allow this EIS to provide the basis for respective agency decisions relative to permitting and other federal actions on the proposed Project.

The USACE is the lead federal agency for this NEPA EIS since it received a permit request from the State of Alaska on November 16, 2009 under the USACE jurisdictional authority pursuant to Section 404 of the Clean Water Act (CWA) [33 U.S. Code (USC) 1344]. The USACE has the authority to issue or deny permits for placement of dredged or fill material in waters of the United States, including wetlands, and for work and structures in, on, over, or under navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899. Consequently, the USACE's authority extends, and its decisions following completion of the EIS will extend, to the entire proposed Project, regardless of land ownership.

AGDC filed a right-of-way (ROW) application in August 2010 under 43 C.F.R. Part 36, Transportation and Utility Systems in and Across, and Access Into, Conservation System Units in Alaska, and consistent with the requirements of Section 28 of the Mineral Leasing Act of 1920 (MLA) as amended with the BLM for the proposed Project across federal lands.

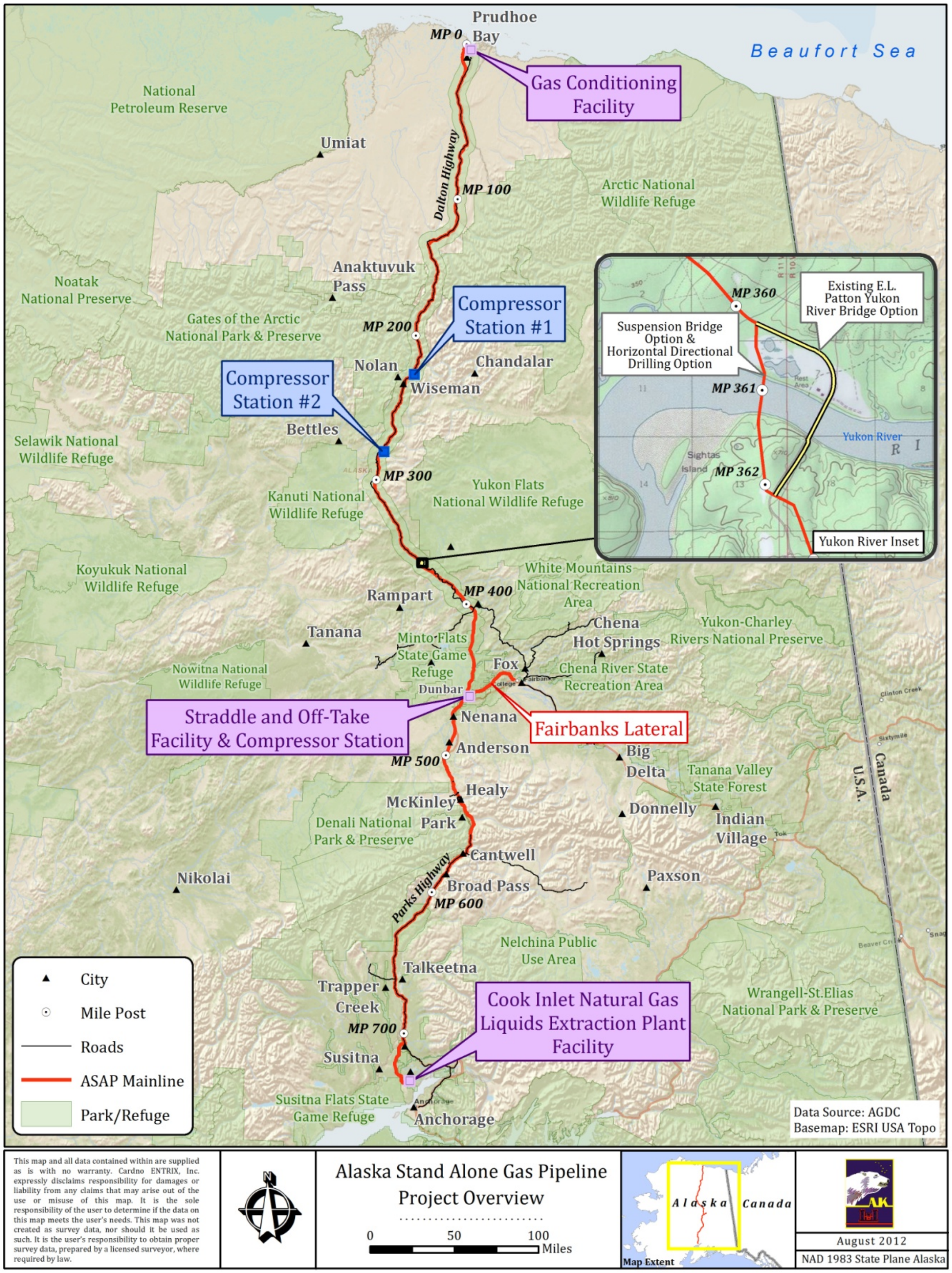


FIGURE 1.0-1 Project Overview

1.1 PROJECT OVERVIEW

As stated previously, the AGDC proposes the construction and operation of a pipeline to transport natural gas and NGLs[1] from the North Slope of Alaska near Prudhoe Bay to Fairbanks, Anchorage, and the Cook Inlet area. The pipeline would transport natural gas and NGLs from existing reserves within Prudhoe Bay gas fields on the North Slope of Alaska for delivery to in-state markets in Fairbanks and Southcentral Alaska. Discovered technically recoverable natural gas resources on Alaska's North Slope are estimated to be about 35 trillion cubic feet (TCF) (DOE 2009). The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. The gas and NGLs would be used for the heating of homes, business, and institutions; the generation of electrical power; and other industrial uses.

The proposed Project would be developed in the general vicinity of the Dalton and Parks Highway Corridors. A 12-inch diameter lateral pipeline would extend about 35 miles from Dunbar, a known location depicted in Figure 1.0-1, east to Fairbanks. Dunbar is one of the many "whistle stops" along the Alaska Railroad that were once of consequence to its operations, but has since faded into history other than the name denoting a general location. The proposed Project's aboveground facilities would include: a North Slope gas conditioning facility (GCF); one or two compressor stations (CS); a straddle and off-take facility near Dunbar; a Cook Inlet natural gas liquids extraction plant (NGLEP); and mainline valves and pig launchers/receivers. Support facilities would include: operations and maintenance buildings; construction camps and pipeline yards; and material sites. The proposed Project is more fully described in Section 2, Project Description.

1.2 PROJECT PURPOSE AND NEED FOR THE PROPOSED ACTION

1.2.1 Applicant's Stated Purpose

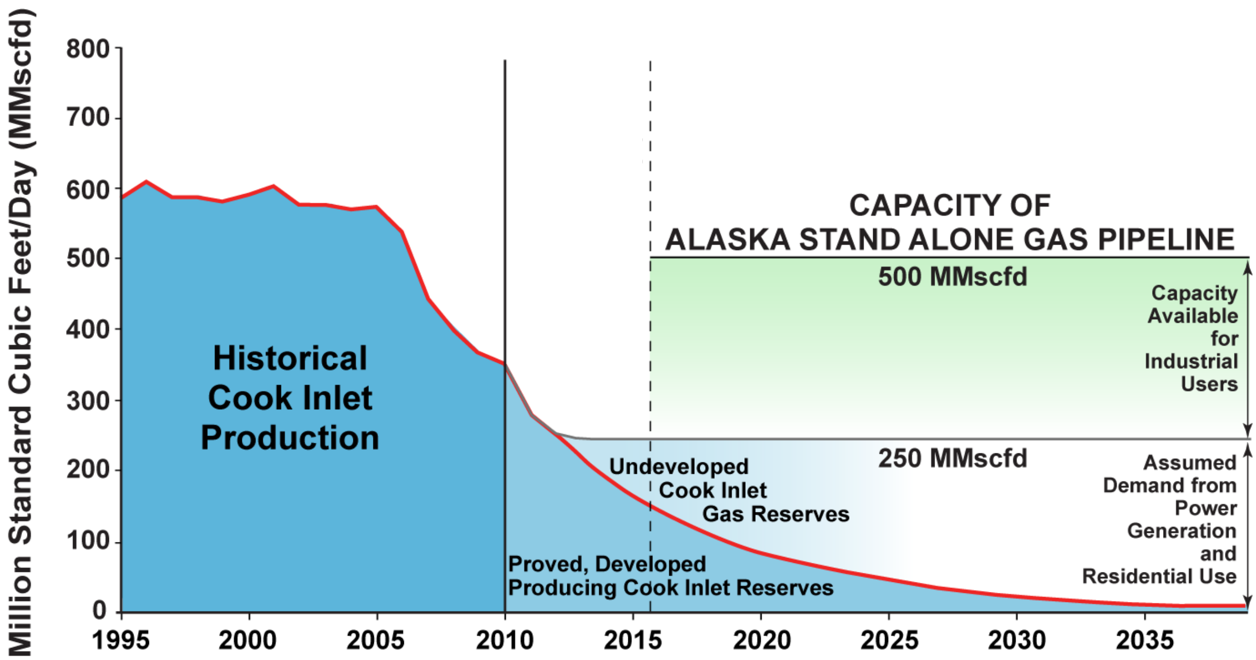
The proposed action is the construction and operation of the proposed pipeline from the North Slope to the Cook Inlet Area in Southcentral Alaska. The applicant's primary purpose for the proposed Project is to provide a long-term, stable supply of up to 500 MMscfd of natural gas and NGLs from existing reserves within North Slope gas fields to markets in the Fairbanks and Cook Inlet areas by the most direct and shortest route possible with production starting in 2019. In addition to providing energy resources to the Fairbanks and Cook Inlet area, the utilization of the proven gas supplies that are readily available on Alaska's North Slope would provide economic benefit to the State of Alaska through royalties and taxes.

1.2.2 Applicant's Stated Need

In 2010, Alaska Statute (AS) 38.34 was passed by the Alaska Legislature. Section 38.34.040 provides for the establishment of an intrastate natural gas pipeline system to address the need for new supplies of natural gas in the Fairbanks and Cook Inlet areas. The Legislature took this

[1] Natural gas liquids include ethane, propane, butane, pentane, and iso-butane.

action for the following reasons. Historically, the existing Cook Inlet gas fields have served the residential and commercial needs of Southcentral Alaska, supplying natural gas for heating and electrical power generation (93 percent of generated electricity uses natural gas) (AGDC 2010). The existing Cook Inlet gas fields are currently supplying approximately 200 MMscfd of natural gas to the region for power generation and residential use (AGDC 2010). Additionally, these fields previously supplied natural gas to large industrial operations at the liquefied natural gas (LNG) export plant at Nikiski[2] and the decommissioned Agrium fertilizer facility in Kenai. These existing fields cannot sustain the area's current and projected natural gas needs. Major new supplies of Cook Inlet natural gas remain unproven. The projected drop in current natural gas production is illustrated in Figure 1.2-1. As a result, demand for Cook Inlet natural gas could exceed available supply by 2013.



Note: Project startup is currently projected for 2019.
Source: AGDC 2010.

FIGURE 1.2-1 Projected Drop in Production at Cook Island Gas Fields

Additionally, Fairbanks has no long-term source of fuel other than fuel oil and wood products. The current air quality in Fairbanks is adversely affected by the combustion of these energy sources and as a result has been classified as an air quality non-attainment area by regulatory agencies. Currently, LNG is trucked in limited supplies to Fairbanks from Cook Inlet suppliers for a small local distribution system[3]. This trucked LNG also relies on the diminishing proven

2 The Nikiski LNG export plant shipped about 21 billion cubic feet of LNG in 2009, off a peak of 64 billion cubic feet (Anchorage Daily News 2011a). The plant is currently in winterization mode but is scheduled to resume exports in 2012 (Anchorage Daily News 2011b).

3 Fairbanks Natural Gas, LLC has been providing liquefied natural gas to Fairbanks since 1998. LNG from Cook Inlet is transported to Fairbanks by tanker trucks, stored, gasified and distributed to approximately 1,100 residential

Cook Inlet gas supply. A long-term, affordable energy source is therefore needed for Fairbanks and the Interior. Community, commercial, and industrial development in Interior Alaska could be facilitated with a reliable supply of natural gas. Existing and future energy users need access to reliable cost-effective energy.

In summary, the proposed Project would fulfill the following needs identified by AGDC:

- Relieve a shortfall of natural gas supply in the Cook Inlet area, which is the primary fuel source for heating and electrical power generation projected in the near future (2013-2015).
- Provide for converting from existing heating sources to natural gas in Fairbanks to reduce harmful air emissions and assist in achieving attainment status. Fairbanks currently is in air pollution non-attainment area status due to particulate matter. Use of oil and wood for heating are major contributors to this problem in winter.
- Provide a stable and reliable supply of natural gas and NGLs to meet current and future demand of up to 500 MMscfd as follows:
  - 200 MMscfd – Cook Inlet area current demand;
  - 50 MMscfd – Additional Cook Inlet area future demand – 2030;
  - 60 MMscfd – Fairbanks current and future demand – 2030;
  - 60 MMscfd – NGLs to be extracted at the Cook Inlet NGL Extraction Plant Facility for future commercial and industrial use; and
  - 130 MMscfd – Future commercial and industrial use.
- Provide a stable and reliable supply of natural gas needed to spur economic development of commercial and industrial enterprises in Fairbanks and the Cook Inlet area.
- Provide economic benefit to the State of Alaska through royalties and taxes. Approximately 82 percent of Alaska's estimated state revenues for 2010 were from oil taxes, royalties, and fees (Reuters 2009).

The proposed pipeline route was selected by the AGDC to minimize total pipeline length and to reduce the amount of challenging terrain and geologic design areas that would be crossed by the proposed Project, thereby reducing construction costs and impacts. As proposed, approximately 82 percent of the proposed pipeline route would be either co-located within or closely parallel existing pipeline or highway ROWs (AGDC 2011).

It is important to note that the proposed Project is an intrastate project independent of the proposed Alaska Pipeline Project (APP), an interstate natural gas pipeline project. TransCanada Alaska Company, LLC (TC Alaska) and ExxonMobil Corporation are studying the feasibility of exporting Alaska's North Slope natural gas through Alberta via the APP, a

and commercial customers (FNG 2011). The current source of gas for Fairbanks is the diminishing Cook Inlet gas field.

proposed large-diameter pipeline. In March 2012, APP and Alaska North Slope gas producers ConocoPhillips and BP agreed to work together on evaluating options for a large-scale liquefied natural gas (LNG) export facility from Southcentral Alaska as an alternative to a natural gas pipeline through Alberta (APP 2012).

As their studies and export plan continue, the near-term need for additional natural gas supplies to supplement Cook Inlet reserves and to serve developed and developing markets within Alaska remains. The APP project is described in greater detail in Section 4.3.3.

1.2.3 USACE Project Purpose

As the identified lead agency and under the requirements of the National Environmental Policy Act of 1969 as amended (42 USC 4321 et seq.) and the Council on Environmental Quality (CEQ) Regulations for implementing the NEPA (40 CFR 1500-1508), it is the USACE's responsibility to prepare the EIS and define the agency's purpose and need. The USACE policy is to define the basic project purpose and the overall project purpose. The basic project purpose is used to determine water dependency [40 CFR 230.10(a)(3)], and the overall project purpose drives the search for alternatives and is used to evaluate the alternatives' practicability under the Section 404(b)(1) Guidelines.

1.2.3.1 Basic Project Purpose and Water Dependency

The basic project purpose for the proposed Project is the transport of natural gas and NGLs. The proposed Project is therefore not considered a water dependent activity. However, the proposed Project is partially sited in jurisdictional wetlands which are considered under regulation to be a "special aquatic site". Therefore, pursuant to 40 CFR 230.10(a)(3), practicable alternatives not involving special aquatic sites[4] are presumed to be available and less environmentally damaging. The Clean Water Act, Section 404(b)(1) guidelines state, "Where the activity associated with a discharge which is proposed for a special aquatic site (as defined in subpart E) does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise."

1.2.3.2 Overall Project Purpose

The overall project purpose is used for evaluating practicable alternatives to the applicant's proposed Project under the Section 404(b)(1) Guidelines and must be specific enough to define the applicant's needs, but not so restrictive as to preclude all discussion of alternatives. Defining the overall project purpose is the responsibility of the USACE; however, the applicant's needs must be considered in the context of the desired geographic area of the development, and the type of project being proposed. Consistent with this responsibility, the USACE has determined that the overall project purpose of the proposed Project is driven by AS 38.34, to

[4] "Special aquatic sites" as found in 40 CFR Part 230, Subpart E include wetlands, sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, riffle and pool complexes.

provide a long-term, stable supply of up to 500 MMscfd of natural gas and NGLs from existing reserves within North Slope gas fields to markets in the Fairbanks and Cook Inlet areas by the most direct and shortest route possible with production starting in 2019 (USACE 2012).

1.2.4 BLM Project Purpose and Need

The BLM's purpose and need for the proposed Project is to respond to the AGDC application under 43 C.F.R. Part 36 — Transportation and Utility Systems in and Across, and Access Into, Conservation System Units in Alaska; and consistent with the requirements of Section 28 of the MLA as amended for the proposed Project across federal lands. The BLM will decide whether to approve, approve with modification, or deny issuance of a ROW grant to AGDC for the proposed Project; and if so, under what terms and conditions. The proposed ROW action appears consistent with approved BLM land use planning.

1.2.5 Agency Participation

This EIS is intended to fulfill the needs and obligations set forth by the NEPA and other relevant laws, regulations, and policies of the USACE (lead agency) and of the BLM, EPA, NPS, ADNR SPCO, PHMSA, and USCG (cooperating agencies).

1.2.5.1 Lead Agency – U.S. Army Corps of Engineers

As the lead agency, the USACE is responsible for the development of the EIS, as well as necessary permits within its jurisdiction. The USACE has the authority to issue or deny permits for placement of dredged or fill material in the waters of the United States, including wetlands, and for work performed and structures in, on, over, or under navigable waters of the United States. Consequently, the USACE's authority extends, and its decisions following completion of the EIS will extend, to the entire proposed Project, regardless of land ownership. The USACE is assigned these responsibilities under the following regulatory frameworks:

- The NEPA sets policy and provides the means by which the federal government, including both the lead agency and the federal cooperating agencies, examines major federal actions that may have significant effects on the environment, such as the authorization of a gas pipeline ROW contemplated in this EIS (42 USC § 4231 et seq.).
- Under Section 404 of the CWA (33 USC § 1251 et seq.), the USACE regulates the discharge of dredged or fill material in waters of the United States, including wetlands.
- Under Section 10 of the Rivers and Harbors Act (33 USC 403), the USACE requires prior approval for any work performed or structures constructed in, on, over, or under navigable waters of the United States, or which affects the course, locations, condition or capacity of such waters.

1.2.5.2 Cooperating Agencies

The BLM, EPA, NPS, ADNR SPCO, PHMSA, and the USCG are participating as cooperating agencies in the NEPA review process and development of this EIS.

Bureau of Land Management (BLM)

The BLM is responsible for land-use authorizations on federal lands. The authority for management of the land and resource development options presented in the EIS comes from several statutes, including the NEPA, the Federal Land Policy and Management Act (FLPMA), the MLA, Title VIII and IX of the Alaska National Interest Lands Conservation Act (ANILCA), and the National Trails System Act. The BLM is assigned these responsibilities under the following regulatory frameworks:

- Under the FLPMA, the Secretary of the Interior has broad authority to regulate the use, occupancy, and development of public lands and to take whatever action is required to prevent unnecessary or undue degradation of public lands (43 USC § 1732). In accordance with the FLPMA, the BLM manages its Alaska lands and their uses to ensure healthy and productive ecosystems.
- Under Section 28 of the MLA (30 U.S.C. 185), under 43 CFR 2881.11, the BLM has the authority to issue grants for oil or gas pipelines or related facilities to cross Federal lands under BLM jurisdiction or the jurisdiction of two or more Federal agencies, except land in the National Park System, land held in trust for Indians, or land within the Outer Continental Shelf. The AGDC would need to obtain a Right-of-Way Grant and Temporary Use Permits from the BLM for crossing lands managed by the BLM or the Department of Defense. The AGDC has submitted a STANDARD FORM 299, Application for Transportation and Utility Systems and Facilities on Federal Lands.
- Title VIII of the ANILCA establishes procedures for federal agencies to evaluate impacts on subsistence uses and needs, and means to reduce or eliminate such impacts (16 USC § 3120).
- Title IX of the ANILCA establishes procedures for federal agencies to grant ROWs on lands selected by, or granted, or conveyed to the State of Alaska under Section 6 of the Alaska Statehood Act (16 USC 410hh-3233, 43 USC 1602-1784).
- Pursuant to the National Trails Systems Act of 1968 (16 USC 1241-1251), the BLM is the statutorily-designated federal administrator for the Iditarod National Historic Trail (INHT), and is the federal point-of-contact for INHT matters.

The BLM's proposed action would be to provide the AGDC with legal access across federal lands for the construction and operation of a natural gas pipeline to bring gas from the North Slope to Southcentral Alaska. The need for the BLM proposed action is established by the BLM's responsibility under the MLA to respond to a request for a ROW grant for legal access across federal lands submitted by the AGDC to construct and operate a 24-inch high-pressure natural gas pipeline.

U.S. Environmental Protection Agency (EPA)

The EPA authority to regulate the proposed Project is contained in the CWA (33 USC § 1251 et seq.), Clean Air Act (CAA) (42 USC § 7401 et seq.), and the Safe Drinking Water Act (SDWA)

(42 USC § 300). As with the authority of the USACE, the EPA's authority extends, and its decisions following completion of the EIS will extend, to the entire proposed Project, regardless of who owns the land. The EPA is assigned these responsibilities under the following regulatory frameworks:

- Under Section 402 of the CWA (33 USC § 1251 et seq.), the EPA oversees the Alaska Department of Environmental Conservation's (ADEC's) administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction[5]. Point-source discharges that require an APDES permit include, but are not limited to: sanitary and domestic wastewater, dewatering of gravel pits and construction areas, and hydrostatic test water, storm water discharges, etc. (40 CFR 122).
- Under Section 404 of the CWA (33 USC § 1251 et seq.), the EPA reviews and comments on the USACE Section 404 permit applications for compliance with the Section 404(b)(1) guidelines and other statutes and authorities within its jurisdiction (40 CFR 230).
- Under Sections 165 and 502 of the CAA (42 USC § 7401 et seq.), the State of Alaska is delegated authority to issue air quality permits for facilities operating within state jurisdiction for the Title V operating permit (40 CFR 70) and the Prevention of Significant Deterioration (PSD) permit (40 CFR 52.21) to address air pollution emissions. The EPA maintains oversight authority of the state's program.
- Under Section 309 of the CAA (42 USC §7401 et seq.), the EPA has the responsibility to review and comment on, in writing, the EIS for compliance with CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500–1508).
- Under Executive Order 11514 Protection and Enhancement of Environmental Quality, the EPA reviews and evaluates the Draft and Final EIS for compliance with CEQ guidelines.
- Under Sections 3001 through 3019 of the Resource Conservation and Recovery Act (RCRA) (42 USC 3251 et seq.), the EPA establishes criteria governing the management of hazardous waste. Any hazardous waste generated at a facility associated with the proposed Project is subject to the hazardous waste regulations administered by the EPA.
- Under the Oil Pollution Prevention regulations (40 CFR Part 112), the EPA requires facilities that store, use, and manage petroleum products to develop a Spill Prevention,

[5] On October 31, 2008, the EPA formally approved the state's National Pollutant Discharge Elimination System (NPDES) Program application. The State's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting, compliance, and enforcement programs is being transferred to the ADEC over 4 years. Oil and gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.

Control and Countermeasure (SPCC) Plan and a Facility Response Plan (FRP). The EPA has the responsibility to review these plans.

National Park Service (NPS)

The NPS is responsible for management of lands within Denali National Park and Preserve for the purpose of this EIS. The NPS is assigned these responsibilities under the following regulatory frameworks:

- Title XI of the ANILCA would apply to the Denali National Park Route Variation Alternative that involves use of lands within Denali National Park and Preserve (NPP) Conservation System Unit (CSU). Transportation systems that are proposed to cross a CSU created or expanded by the ANILCA require an act of Congress if such transportation system would cross any congressionally-designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska.
- The NPS Organic Act would apply to the Denali National Park Route Variation Alternative that involves use of lands within the Denali NPP. The Organic Act gives the NPS the authority to grant permits and regulate the use of public lands and to take whatever action is required to prevent unnecessary or undue degradation of these lands.
- The NPS has oversight responsibility for certain state and local recreational resources pursuant to Section 6(f)(3) of the Land and Water Conservation Fund (LWCF) Act (Public Law 88-198) and its implementing regulations within 36 CFR Part 59. Section 6(f)(3) would apply to segments of the pipeline constructed within Denali State Park. Section 6(f)(3) prohibits the conversion of property acquired or developed with LWCF grants to a non-recreational purpose without the approval of the NPS and replacement lands of equal value, location and usefulness. In Alaska the Section 6(f)(3) program is administered by the Alaska Division of Parks and Outdoor Recreation (ADPOR).

Alaska Department of Natural Resources, State Pipeline Coordinator's Office (ADNR, SPCO)

The ADNR manages development on its lands within the proposed Project corridor on which the proposed pipeline ROW is located. A State of Alaska Title 38 Right-of-Way Lease is required for use of state lands. The SPCO specifically manages the ROW and the lands encompassed by the ROW in accordance with the lease for the purposes of construction, operation, maintenance and termination of a pipeline and all pipeline associated actions.

The State of Alaska is responsible for regulating activities and developments on federal, state, and private lands that may affect air or water quality or resident species of fish and wildlife. The State of Alaska is also responsible for providing for subsistence use of fish and wildlife. This EIS studies development options that will help the State of Alaska meet its responsibilities under various state statutes including AS Title 16 (Fish and Game), Title 31 (Oil and Gas), Title 38 (Public Land), Title 41 (Public Resources), and Title 46 (Water, Air, Energy, and Environmental

Conservation). Consequently, following completion of the EIS, the State will make some decisions on the entire proposal, while it will make other decisions that rest with the role of manager of state owned lands. The AGDC submitted a Right-of-Way Leasing Act AS 38.35.050 Application for Pipeline Right-of-Way Lease on March 21, 2011. The State of Alaska issued Right-of-Way Lease ADL 418977 to the AGDC on July 25, 2011 (Appendix M).

U.S. Department of Transportation (USDOT), Pipeline and Hazardous Materials Safety Administration (PHMSA)

The USDOT is mandated to provide pipeline safety under Title 49, USC Chapter 601. The PHMSA is responsible for regulating and ensuring the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines. The PHMSA administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. The USDOT pipeline standards are published in 49 CFR 190 to 199. Part 192 specifically addresses natural gas pipeline safety issues, Part 193 addresses LNG facilities, and Part 195 addresses NGL pipelines. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety.

U.S. Coast Guard (USCG)

The USCG is responsible for any structures erected across navigable waters of the United States. The USCG has authority under Section 9 of the Rivers and Harbors Act of 1899 to approve construction of any bridge including causeways, approaches, fenders and other appurtenances, across navigable waters to ensure safe navigability of waterways. The USCG exercises its authority to prevent unauthorized obstruction or alteration of the nation's navigable waters (33 USC 403). Within the proposed Project area, the USCG decisions will address any potential obstruction, including bridges, of navigable rivers and their tributaries.

1.2.5.3 Commenting Agencies

Federal, state and local agencies that are not designated cooperating agencies and have an interest in the proposed pipeline project are considered commenting agencies. An agency scoping meeting was conducted on December 18, 2009, to share information and discuss issues related to the proposed Project. Commenting agencies that participated in the agency scoping process included the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries; NMFS), U.S. Fish and Wildlife Service (USFWS), Alaska Department of Fish and Game (ADF&G), ADEC, and the Matanuska-Susitna (Mat-Su) Borough.

1.3 TRIBAL CONSULTATION AND COORDINATION

Pursuant to the Executive Memorandum of April 29, 1994, on Government-to-Government Relations with Native American Tribal Governments, federal agency leaders are "responsible for ensuring that each agency operates within a government-to-government relationship with federally recognized" tribes. Further, each agency is tasked with consulting with potentially affected tribal governments "prior to taking actions that affect federally recognized tribal governments." Each agency must also evaluate the "impact of Federal Government plans, projects, programs, and activities on tribal trust resources and assure that tribal government rights and concerns are considered during the development of such plans, project programs, and activities" (Clinton 1994). The USACE follows the United States Department of Defense American Indian and Alaska Native Policy guidance for developing and maintaining government-to-government relationships with federally recognized tribes. This section outlines the USACE's approach to conducting consultation and coordination with tribes for the proposed Project EIS development process.

As the lead agency for this EIS, the USACE is responsible for government-to-government consultation and coordination with federally recognized tribes that may be impacted by this proposed Project. The USACE initially invited 41 potentially affected, federally recognized tribes to participate in the proposed Project EIS NEPA process through consultation and coordination. After the route elimination process, the number of tribes within the proposed Project corridor was changed to 28 tribes who remain potentially affected by the proposed Project. The tribes considered to be potentially affected by the proposed Project by virtue of their location along the proposed pipeline corridor are:

- Alatna Village;
- Allakaket Village;
- Village of Anaktuvak Pass;
- Arctic Village Council;
- Inupiat Community of the Arctic Slope (ICAS) [Indian Reorganization Act (IRA)];
- Native Village of Barrow Inupiat Traditional Government;
- Beaver Village Council;
- Birch Creek Tribal Council;
- Native Village of Cantwell;
- Circle Native Community (IRA);
- Cheesh-Na Tribal Council;
- Chickaloon Native Village;
- Native Village of Eklutna;
- Evansville Village;

- Gwitchyaa Gwichin Tribal Government Native Village of Fort Yukon (IRA);
- Kaktovik Village;
- Kenaitze Indian Tribe (IRA);
- Knik Village;
- Manley Hot Springs Village;
- Native Village of Minto (IRA);
- Nenana Native Association;
- Ninilchik Traditional Council;
- Native Village of Nuiqsut;
- Rampart Village;
- Native Village of Stevens (IRA);
- Tanacross Village Council;
- Native Village of Tanana (IRA); and
- Native Village of Tyonek (IRA).

It is the USACE's goal to consult early and often with federally recognized tribes that may be impacted by the activities of the proposed Project. The following milestones and opportunities for meaningful participation by tribal governments have been provided thus far during the EIS process:

Notification and invitation to consult letter sent (October 19, 2009): An initial notification and invitation to consult letter was sent to the 41 tribes originally identified as potentially affected by the proposed Project on October 19, 2009. The letter briefly described the proposed Project, offered government-to-government consultation, and invited tribes to a teleconference on November 6, 2009. The letter included a consultation questionnaire for the tribes to return to the USACE indicating their level of interest and expected engagement in the proposed Project EIS. Telephone calls were made to the tribes to ensure that the letters were received and to confirm attendance at the teleconference. Several tribes requested e-mail and fax follow-ups with the letter attached.

Teleconference for Tribes (November 6, 2009): The USACE provided the tribes with a toll free teleconference number to join in the first informational discussion regarding the proposed Project and EIS development on November 6, 2009.

Chickaloon meeting (March 16, 2010): On Tuesday, March 16, 2010, USACE representatives travelled to Sutton for a meeting with representatives of the Chickaloon Traditional Council. The Tribal Council had invited the USACE to meet with them to discuss the development of the EIS.

Phone calls to Tribes (November 2010): Phone calls were made to the 41 tribes originally consulted to update their contact information, including current leadership points-of-contact and e-mail addresses.

Invitation to teleconference (November 19, 2010): On November 19, 2010, the USACE e-mailed invitations to the 41 tribes originally consulted for a second teleconference to be held on December 8, 2010. Some invitations were faxed to those tribes that did not provide an e-mail address. A reminder was sent via e-mail and fax on December 6, 2010.

Teleconference for Tribes (December 8, 2010): The USACE provided tribes with a toll free teleconference number to join in the second informational teleconference for tribes to discuss the proposed Project and EIS development on December 8, 2010. A summary of the meeting was sent to the 41 tribes (including those that were not able to attend) via e-mail and fax on December 8, 2010.

Invitation to teleconference (April 12, 2011): On April 12, 2011, the USACE e-mailed invitations to the 41 tribes originally consulted for the third teleconference to be held on April 28, 2011. Some invitations were faxed to those tribes that did not provide an e-mail address. A reminder was sent via e-mail and fax on April 27, 2011.

Teleconference for Tribes (April 28, 2011): The USACE provided the tribes with a toll free teleconference number to join in the third informational discussion regarding the updated project proposal based on the March 2011 revised Plan of Development (POD) on April 28, 2011. A summary of the meeting was sent to the 41 tribes (including those that were not able to attend) via e-mail and fax on May 6, 2011.

Invitation to teleconference (November 3, 2011): An e-mail invitation was sent to the tribes for a teleconference on November 21, 2011.

Teleconference for Tribes (November 21, 2011): The USACE provided an update to the project including the portions of the proposed Project that have been eliminated; Mary Romero was introduced as the new USACE project manager. Tribes were asked how they would like to receive their copy of the Draft EIS and notified of an upcoming teleconference for commenting in early February as well as a follow up teleconference in late March to discuss final comments.

Letter to the Tribes (December 16, 2011): A letter was sent containing the minutes from the previous teleconference, providing the schedule and call in numbers for the next two teleconferences in February and March, and providing a questionnaire to those tribes that were not party to the conference to ask them how they wished to receive a Draft EIS.

Notice of Availability for the Draft EIS (January 13, 2012): The Notice of Availability for the Draft EIS was sent out to all 41 tribes.

Letter to the Tribes (January 24, 2012): A letter was sent to the tribes inviting them to the telephonic public comment session for the Draft EIS.

Teleconference for Tribes (February 2, 2012): A teleconference was held for all Tribal entities to comment on the Draft EIS and ask questions. On February 22, 2012, an e-mail with the transcription of the teleconference was sent to the tribes.

Notification of Extension of the Draft EIS Comment Period (March 7, 2012): A notification of the extension of the Draft EIS comment period was sent to the 41 tribes.

Meetings Notification (March 13, 2012): An e-mail was sent to the tribes notifying them of the extension, and the meeting dates and venues for Minto and Wiseman meetings as well as the new teleconference date of May 9, 2012, to share concerns addressed by all tribes.

Teleconference for Tribes (May 9, 2012): A teleconference was held for all Tribal entities to discuss and address their concerns.

1.4 SCOPING PROCESS

1.4.1 Intent of Public Scoping

The public was invited to participate in the Scoping Process, both to help define the environmental issues to be analyzed and to identify the range of reasonable alternatives to be considered in the EIS. The Scoping Period began with the publication of a NOI to prepare an EIS and conduct Public Scoping Meetings.

1.4.1.1 Scoping Notice

On December 4, 2009, the USACE published the NOI to prepare an EIS in the *Federal Register*. On the same date, the USACE sent a public notice to affected parties regarding the EIS public scoping meetings and how to obtain more information on the proposed Project. The NOI initiated the scoping period, which was originally scheduled to begin December 7, 2009, and close on February 5, 2010. In response to a request from a project stakeholder, the scoping period was extended to March 8, 2010. This extension was announced through a Public Notice distributed to the original stakeholder mailing list on February 5, 2010. Copies of the NOI and the Public Notice are included in Appendix A of the Scoping Report (Appendix B of the Final EIS).

Newspaper announcements for the scoping meetings were advertised in the *Copper River Record* on December 3, 2009; the *Delta Wind* online edition on December 7, 2009; the *Fairbanks Daily News Miner* on December 9-10, 2009; the *Anchorage Daily News* on December 14, 2009; the *Mat-Su Valley Frontiersman* on December 10 and 15, 2009; and the *Arctic Sounder* on December 17, 2009. A public service announcement was e-mailed on December 1, 2009, to the KXGA radio station. Online announcements were posted on the Delta News Web calendar on December 2, 2009, and the KSKA Anchorage Public Radio datebook calendar on December 10, 2009.

Scoping period deadline reminders were advertised in newspaper announcements in the *Mat-Su Valley Frontiersman* on January 17, 19, and 22, 2010; the *Copper River Record*, *Delta Wind*, and the *Arctic Sounder* on January 21, 2010; and the *Fairbanks Daily News Miner* on January 22-28, 2010. An online reminder announcement with a link to the proposed Project website was posted on the *Anchorage Daily News* homepage on January 18-24, 2010, and Peg Tileston's *What's Up* on January 22, 2010.

An extension of the scoping period was advertised in newspaper announcements in the *Copper River Record*, *Delta Wind*, and the *Arctic Sounder* on February 18, 2010; and the *Mat-Su Valley Frontiersman* on February 19, 21, and 23, 2010. Online extension announcements with a link to the proposed Project website were posted on the *Anchorage Daily News* and *Fairbanks Daily News Miner* homepages on February 19-26, 2010. Copies of the scoping notices are included in Appendix B of the Scoping Report (Appendix B of the Final EIS).

1.4.1.2 Public Scoping Meetings

The USACE hosted eight public scoping meetings (see Table 1.4-1) in December 2009. The purpose of these meetings was to disseminate proposed Project information, solicit public input, and identify issues and concerns that the public believed should be addressed in the EIS. The scoping meetings were minimally attended with a few public comments received in some locations. Three scoping meetings did not receive any attendees. Much of the discussion by those in attendance focused on details regarding design, alignment, and the relationship of the proposed Project to other gas pipeline projects.

Each meeting included an open house, a brief formal presentation, and a public question and comment period. The same proposed Project information was presented at all public scoping meetings. A professional court reporter recorded transcripts of each of the public scoping meetings with attendees. The transcripts of public comments are included in Appendix F of the Scoping Report (Appendix B of the Final EIS).

An agency scoping meeting was held on December 18, 2009, at 1:00 p.m. at the BLM Office in Anchorage. This meeting provided a specific opportunity for agencies to hear the scoping meeting presentation and to ask questions of clarification regarding the proposed Project. The presentation and discussion served as a common foundation for identification of issues and concerns by federal and state agencies with jurisdiction and responsibility for resources potentially affected by the proposed Project. The agencies were asked to provide their scoping comments in writing. Comment submissions are included in Appendix D of the Scoping Report (Appendix B of this Final EIS).

TABLE 1.4-1 Scoping Meetings, Locations, Dates, and Times

Date	Time	Location	Venue	Venue Address
December 8, 2009	5-8 PM	Glennallen	Tazlina Village Hall	MP 110.5 Richardson Highway, Glennallen
December 9, 2009	5-8 PM	Delta Junction	Delta Junction Community Center	2287 Deborah Street, Delta Junction
December 10, 2009	11 AM – 1 PM	Nenana	Nenana Civic Center	723 North A Street, Nenana
December 10, 2009	5-8 PM	Fairbanks	Pioneer Hall at Pioneer Park	2300 Airport Way, Fairbanks
December 11, 2009	11 AM – 1 PM	Denali National Park/ McKinley Village	McKinley Park Community Center	MP 230 Parks Highway, McKinley Park
December 14, 2009	5-8 PM	Anchorage	Anchorage Senior Activity Center	1300 East 19th Avenue, Anchorage
December 15, 2009	5-8 PM	Wasilla	Curtis D Menard Memorial Sports Center	1001 South Mack Drive, Wasilla
December 16, 2009	2-6 PM	Barrow	Inupiat Heritage Center	5421 North Star Street, Barrow

1.4.1.3 Comments Received and Issues Identified during Scoping

Seventeen unique comment submissions were received during the scoping period, including 4 from state or federal agencies, 1 from local government, 1 from a State Representative, and 11 from non-profit organizations, businesses and the general public. In addition, oral comments were provided and recorded at all meetings, with the exception of the agency meeting in Anchorage and the scoping meetings with no attendance (Glennallen, Delta Junction, and Wasilla). All scoping submissions and comments from members of the public can be seen in their entirety in Appendix E of the Scoping Report (Appendix B of the Final EIS). Table 1.4-2 summarizes the most common issues raised during the scoping period along with the section in this EIS that addresses the concern.

TABLE 1.4-2 Comments Received on Environmental Issues during the Public Scoping Process for the Proposed Project

Issue	Comment	Section where Comment / Issue Addressed in EIS
Public Involvement	Comments were received regarding communication and outreach to communities and with other projects. One commenter suggested a citizen’s advisory group for the proposed Project. Comments were received regarding other in-state and inter-state pipeline projects.	1.7
Alternatives	One commenter requested an oil line in addition to the proposed gas line from Gubik. Another commenter requested Gubik region gas to be a source option for the proposed gas line. One commenter suggested the East Curry Route Alternative, not included in the project documents, which would bypass the Parks Highway.	4.0
Wildlife and Fisheries	Comments were received identifying impacts to wildlife and fisheries habitat.	5.5 and 5.6
Land Use/Recreation	Comments identified competing land uses along the proposed route. One commenter submitted 225 signatures on a petition to include multi-use paths in the Project design.	5.9 and 5.11

TABLE 1.4-2 Comments Received on Environmental Issues during the Public Scoping Process for the Proposed Project

Issue	Comment	Section where Comment / Issue Addressed in EIS
Socioeconomic	Commenters suggested the EIS include a cost/benefit analysis of the proposed Project, local use of natural gas, health impact analysis, and environmental justice.	5.13
Cumulative Impacts	Comments were received regarding cumulative impacts, fish and wildlife habitat impacts, future development of minerals and petroleum products.	5.20

1.4.2 Additional Public Outreach

Due to the length of time since the end of the scoping period, change in the applicant, and refinements in the proposed Project description, the USACE posted a newsletter on March 23, 2011, on the proposed Project website[6]. The newsletter was also distributed through the stakeholder mailing list. The newsletter provided a summary of the scoping meetings, a timeline of the NEPA process, details on the proposed Project history, and a description of the next steps regarding the analysis of alternatives.

The applicant has also held meetings within the communities surrounding the proposed Project in order to inform the public about their proposed project. The dates and locations of these community meetings are shown in Table 1.4-3.

TABLE 1.4-3 Community Meetings Sponsored by the Applicant

Date	Community/Organization	Location
March 9, 2011	Community of Minto	Minto
April 8, 2011	Mayors of Fairbanks, Fairbanks North Star Borough, North Pole, Minto Development Corp., TCC	Fairbanks
April 14, 2011	Community of Nenana	Nenana
April 15, 2011	Community of Fairbanks	Fairbanks
April 28, 2011	Community of Barrow	Barrow
May 17, 2011	Community of Wasilla	Wasilla
June 14, 2011	Community of Minto	Minto
June 16, 2011	Community of Kenai	Kenai
July 12, 2011	Clear Airforce Station	Clear AFS
July 13, 2011	Anderson Assembly Meeting	Anderson
July 18, 2011	Anchorage Chamber Meeting	Anchorage
July 20, 2011	Chugiak/Eagle River Chamber Meeting	Chugiak
July 26, 2011	Fairbanks Chamber Meeting	Fairbanks
July 27, 2011	Mayors Energy Task Force	Anchorage

[6] A copy of the newsletter can be viewed on the proposed Project website, at http://asapeis.com/Newsletter.aspx.

TABLE 1.4-3 Community Meetings Sponsored by the Applicant

Date	Community/Organization	Location
August 3, 2011	Anchorage Rotary East	Anchorage
August 10, 2011	Alaska Builders & Contractors	Fairbanks
August 17, 2011	Community of Anaktuvuk	Anaktuvuk
August 24, 2011	Palmer Chamber	Palmer
August 25, 2011	Anchorage Rotary South	Anchorage
September 8, 2011	Alaska's Gas – What's Next Forum	Anchorage
September 13, 2011	Community of Cantwell	Cantwell
September 14, 2011	Community of Talkeetna	Talkeetna
September 20, 2011	Community of Healy	Healy
October 4, 2011	Barrow Planning Commission	Barrow
October 5, 2011	Mechanical Engineers Meeting	Fairbanks
October 6, 2011	Community of Fairbanks, Fairbanks Chamber, Fairbanks Rotary	Fairbanks
November 1, 2011	Community of Barrow	Barrow
November 9, 2011	In-State Gas Caucus	Fairbanks
November 20, 2011	Alaska Municipal League	Fairbanks
November 30, 2011	Iditarod Trail Meeting	Anchorage
December 2, 2011	Law Seminars International	Anchorage
January 5, 2012	Community of Kenai	Kenai
January 25, 2012	Community of Anchorage	Anchorage
January 26, 2012	Annual Alliance Industry Outlook Forum, Kenai/Soldotna	Kenai
February 8, 2012	TCC, Minto 2nd Chief	Fairbanks
March 5-6, 2012	Leadership representing Native Village, ASRC, City, NSB, UIC, ICAS	Barrow
March 12-16, 2012	TCC Annual Conference	Fairbanks
March 23, 2012	TCC, Minto Development Corp, Nenana Basin Gas Coalition	Fairbanks
April 4-5, 2012	TCC, Minto 2nd Chief	Fairbanks
April 12, 2012	Community of Barrow	Barrow
April 11, 2012	Fairbanks Chamber sub-committees, Energy & Gov't Affairs	Fairbanks
April 12, 2012	Community of Barrow	Barrow
April 17, 2012	ASCE – American Society of Civil Engineers	Anchorage
April 18, 2012	APICC – Alaska Process Industry Careers Consortium	Anchorage
April 25, 2012	Dimond High Engineering Academy	Anchorage
May 9, 2012	Nenana, Fairbanks, Kenai, Minto, Stevens Village, TCC, AHTNA	Fairbanks
May 17, 2012	ANSEP - NGO - Alaska Native Science and Engineering Program	Fairbanks

TABLE 1.4-3 Community Meetings Sponsored by the Applicant

Date	Community/Organization	Location
May 21, 2012	Fairbanks Alliance, Governor Parnell	Fairbanks
May 22, 2012	Fairbanks Chamber Member Forum	Fairbanks
May 29, 2012	BLM Subsistence, Cantwell Village Council	Cantwell
June 12, 2012	Community of Nenana, Toghotthele Corporation, Seth-De-Ya-Ah Corporation	Nenana
June 13, 2012	Community of Healy, Denali Borough, Denali Park Community Council, McKinley Village residents	Healy
June 14, 2012	Nenana, Fairbanks, Kenai, Minto, Denali Borough, TCC, AHTNA, Fairbanks Chamber	Fairbanks
June 19, 2012	Community of Manley Hot Springs	Manley Hot Springs
June 19, 2012	Community of Minto, Seth-De-Ya-Ah Corporation	Minto
June 26, 2012	Community of Fairbanks	Fairbanks
July 10, 2012	Community of Kenai	Kenai
July 12, 2012	Community of Fairbanks	Fairbanks
July 12, 2012	Nenana, Fairbanks, Kenai, Minto, Denali Borough, TCC, AHTNA, Doyon	Fairbanks
July 30, 2012	In-State Gas Caucus	Anchorage
August 9, 2012	Community of Anaktuvuk	Anaktuvuk
August 15, 2012	Willow Chamber of Commerce	Willow
August 16, 2012	Nenana, Fairbanks, Kenai, Minto, Denali Borough, TCC, AHTNA, GPPO	Fairbanks
August 22, 2012	Community of Nuiqsut	Nuiqsut
August 28, 2012	Wasilla/Palmer Joint Chamber of Commerce	Wasilla

1.5 DRAFT EIS DISTRIBUTION AND COMMENT PROCESS

1.5.1 Notice of Availability and Draft EIS Distribution

The Draft EIS for the proposed Project was issued for public review on January 9, 2012, and the Notice of Availability (NOA) was subsequently published by the USEPA in the *Federal Register* (77 FR No. 13) on January 20, 2012. The NOA provided a summary of the proposed Project and the Draft EIS alternatives, announced public meetings that were scheduled to solicit feedback from the public on the Draft EIS, and provided instructions for viewing the Draft EIS. The NOA also announced a 45-day review and comment period that began on January 20, 2012, and was scheduled to end on March 5, 2012. The public comment period was subsequently extended an additional 30 days and formally concluded on April 4, 2012. The USACE made the decision to grant an extension based upon receiving several communications from the public requesting additional time to comment, as well as the fact that several public meetings were scheduled within a few days of the original date that the comment period would have ended.

The NOA was distributed to the stakeholder mailing list, which includes agencies, elected officials, media organizations, tribes, private landowners, and other interested parties. A newsletter was posted on the Project website[7] during January 2012 that provided information on how to view the Draft EIS, listed the locations of the public meetings for the Draft EIS, and provided an update and history of the proposed Project. The newsletter was also distributed through the stakeholder mailing list.

Members of the public were invited to view the Draft EIS on the proposed Project website at http://www.asapeis.com. A printed Executive Summary and a copy of the entire Draft EIS on one CD were also available by request through the Project website. Approximately 50 hard copies and 150 compact discs containing the Draft EIS were distributed to agencies, tribes, and the general public through the mail and at public meetings. The Draft EIS was also made available in the libraries and information centers shown in Table 1.5-1.

TABLE 1.5-1 Public Locations for the Draft EIS

Community	Library/Information Center	Address and Phone Number
Anchorage	Alaska Resources Library and Information Services (ARLIS)	3211 Providence Drive, Suite 111 (907) 272-7547
	Z. J. Loussac Public Library	3600 Denali Street (907) 343-2975
	Bureau of Land Management Alaska State Office Public Information Center	222 West 7th Ave. #13 (907) 271-5960
	Alaska Department of Natural Resources Public Information Center	550 W. 7th Ave Ste 1260 (907) 269-8400
	UAA/APU Consortium Library	3211 Providence Drive (907) 786-1871
Barrow	Tuzzy Consortium Library	5421 North Star Street (907) 852-1720
Cantwell	Cantwell Community Library	1 School Road (907) 768-2372
Denali Park	Denali National Park Library	MI 237 Parks Hwy (907) 683-2294
Healy	Tri-Valley School/Community Library	400 Suntrana Road Healy, AK 99743 907-683-2267 (ext. 18)
Fairbanks	Fairbanks North Star Borough Public Library	1215 Cowles Street (907) 459-1020
	Bureau of Land Management Public Room	1150 University Avenue (907) 474-2200
	Alaska Department of Natural Resources Public Information Center	3700 Airport Way (907) 451-2705
Minto	Minto School Library	Laker One Street (907) 798-7212

[7] A copy of the newsletter can be viewed on the proposed Project website, at http://asapeis.com/Newsletter.aspx.

TABLE 1.5-1 Public Locations for the Draft EIS

Community	Library/Information Center	Address and Phone Number
Nenana	Nenana Public Library	106 East 2nd Nenana, AK 99760 (907) 832-5812
Nikiski	Nikiski North Star Elementary School Library	52275 Education Drive Nikiski, AK 99611 (907) 776-3456
Talkeetna	Talkeetna Public Library	23151 South Talkeetna Spur Talkeetna, AK 99676 (907) 733-2359
Trapper Creek	Trapper Creek Public Library	8901 East Devonshire Drive Trapper Creek, AK 99683 (907) 683-2294
Wasilla	Wasilla Public Library	391 North Main Street (907) 376-5913
Willow	Willow Public Library	23557 Willow Drive Willow, AK 99688 907-495-7323

An additional newsletter announcing the availability of the Final EIS is scheduled to be circulated upon publication of the NOA for the Final EIS, with a final newsletter to be circulated upon publication of the USACE Record of Decision (ROD).

1.5.2 Draft EIS Public Meetings

Residents of potentially affected communities were notified of the upcoming public meetings through radio announcements, newspaper publications, emails, and posted notices. Public service announcements informing communities of the public meeting dates and locations were made on the following radio stations: KBRW 91.9 FM (Barrow), KUAC 89.9 FM (Fairbanks), KTNA 88.9 (Talkeetna), KSKA 91.1 FM (Anchorage), and KDLL 91.9 (Kenai). Notices were printed and posted in the Healy and Cantwell post offices and in public places throughout Anaktuvuk Pass and Nenana. Residents of Wiseman and Coldfoot were emailed the notice. The newspapers which published the schedule for the public meetings and the dates on which the ads were run are shown in Table 1.5-2.

TABLE 1.5-2 Newspapers in which the Schedule of Public Meetings was Published

Community	Publication Name	Frequency of Publication	Publish Date(s)
Anchorage	Anchorage Daily News	Daily	February 19, 2012
	Anchorage Press	Weekly	February 16, 2012
	Petroleum News	Weekly	February 12-18, 2012
	Alaska Journal of Commerce	Weekly	First two weeks in February 2012
Fairbanks	Fairbanks Daily News Miner	Daily	February 19, 2012
Kenai	Peninsula Clarion	Daily	February 10 and 12, 2012
Talkeetna	Talkeetna Good Times	Bi-weekly	February 16, 2012
Matanuska-Susitna/Wasilla	Frontiersman	Tuesdays, Fridays, and Sundays	February 19, 2012

The USACE held public meetings in Kenai, Anaktuvuk Pass, Fairbanks, Nenana, Cantwell, Trapper Creek, Willow, Anchorage, Barrow, Wiseman/Coldfoot, and Minto between February 13 and April 2, 2012 (see Table 1.5-3). The meetings consisted of an open house/presentation format to provide the public with updates on the project that was followed by the submission of public comments. The agenda for the meetings was as follows:

- 15 minutes to view maps and other visual aids;
- 15 minutes of introductions of the lead agency and cooperating agencies; and
- A 30 minute presentation of the proposed Project by the third party contractor.

The following entities were introduced during the presentation to the public when in attendance: USACE, BLM, EPA, NPS, ADNR SPCO, USCG, USDOT-PHMSA, the Applicant, and Cardno ENTRIX (third-party contractor). The requirements of the NEPA process were then discussed, followed by an overview of the project's purpose and need, the proposed project route and project features, and route alternatives and variations. The environmental resources analyzed in the Draft EIS were discussed, as well as project safety features. The presentation concluded by providing information on opportunities for public participation, including the opportunity to attend additional public meetings and to submit written comments.

A total of 167 people attended the public meetings. Oral comments were submitted by 37 people, which were transcribed by a professional court reporter. In addition, a total of 2 written comments were submitted at the meetings using comment forms provided at the registration table.

TABLE 1.5-3 Draft EIS Public Meetings, Locations, Dates, and Times

Date	Time	Community	Venue	Address
February 13, 2012	6-7 pm Open House/Presentation 7-8:30 pm Public Comment	Kenai	Challenger Learning Center, Aurora	9711 Kenai Spur Hwy
February 16, 2012	1-2pm Open House/Presentation 2-6pm Public Comment	Anaktuvuk Pass	Anaktuvuk Pass City Hall	P.O. Box 21030 Anaktuvuk Pass, AK 99721-0030
February 21, 2012	6-7 pm Open House/Presentation 7-8:30 pm Public Comment	Fairbanks	Westmark Hotel Yukon Room	813 Noble Street, Fairbanks, AK 99701
February 22, 2012	5-6 pm Open House/Presentation 6-8 pm Public Comment	Nenana	Chief Mitch Demientieff Tribal Hall	P.O. Box 356 307.8 Mile Parks Hwy Nenana, AK 99760
February 23, 2012	12:30-1:30 pm (Open House/Presentation) 1:30-3:00 pm (Public Comment)	Cantwell/Healy/ McKinley Village	Cantwell K-12 School	P.O. Box 29 Cantwell, AK 99729
February 23, 2012	6:30 -7:30 pm (Open House/Presentation) 7:30-9 pm (Public Comment)	Talkeetna/Trapper Creek	Trapper Creek Elementary School	P.O. Box 13108 6742 E. Petersville Rd Trapper Creek, AK 99683

TABLE 1.5-3 Draft EIS Public Meetings, Locations, Dates, and Times

Date	Time	Community	Venue	Address
February 24, 2012	5-6 pm Open House/Presentation 6-8 pm Public Comment	Willow	Willow Community Center	P.O. Box 1027 S. Parks Hwy Willow, AK, 99688
February 27, 2012	6-7 pm Open House/Presentation 7-8:30 pm Public Comment	Anchorage	Sheraton Anchorage Hotel, Kuskokwim	401 East 6th Avenue Anchorage, AK 99501
February 28, 2012	6-7 pm Open House/Presentation 7-8:30 pm Public Comment	Barrow	Inupiat Heritage Center	5421 Northstar St, Barrow, AK 99723
March 2, 2012	1-2 pm Open House/Presentation 2-3:30 pm Public Comment	Wiseman/Coldfoot	Teleconference	NA
March 20, 2012	1:30-2:30 pm Open House/Presentation 2:30-4 pm Public Comment	Minto/Manley Hot Springs	Minto Lake View Lodge	Lake View Street Minto, AK 99758
April 2, 2012	1-1:30 pm Open House/Presentation 1:30-3 pm Public Comment	Wiseman/Coldfoot	Wiseman Community Center	NA

1.5.3 Response to Public Comments on the Draft EIS

1.5.3.1 Response-to-Comment Process

The USACE received a total of 45 communications that included approximately 1300 comments during the Draft EIS comment period of January 20 through April 4, 2012. These communications occurred via letter, e-mail, fax, website, and as submittals at formal public meetings. Comment communications were received from elected officials, federal, state, and local agencies, organizations, and citizens. In addition, oral comments were submitted by 37 people at the public meetings. The oral comments were transcribed by a professional court reporter.

Comment letters and public meeting transcripts were assigned tracking numbers, compiled within a database, and entered into the Administrative Record. All comment letters and meeting transcripts were reviewed and comments requiring specific responses were identified.

1.5.3.2 Specific Issues and Responses

Comments on the Draft EIS and responses to those comments are provided in Appendix S of the Final EIS. The text of the Final EIS was edited and clarified after consideration of the comments received. The comment matrix containing comments, responses, and the location of changes within the EIS resulting from the comments, is provided in Appendix S.

1.6 PERMITS, APPROVALS, COMPLIANCE WITH EXECUTIVE ORDERS AND REGULATORY REQUIREMENTS

This EIS is intended to fulfill the needs and obligations set forth by the NEPA and other relevant laws, regulations, and policies of the lead and cooperating agencies, as described in Section 1.2.5. Several other federal, state, and local government agencies have authorities that would apply to the proposed action. These include the following federal and state agencies: U.S. Fish and Wildlife Service (USWFS); NOAA Fisheries; ADEC; ADF&G; Alaska Department of Transportation and Public Facilities (DOT&PF); and the Alaska Railroad Corporation (ARRC). Local authorities include the North Slope Borough (NSB), Fairbanks North Star Borough (FNSB), Denali Borough, Mat-Su Borough, and the City of Nenana. Table 1.6-1 summarizes authorities that apply to the proposed action.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Federal		
Federal Laws and Executive Orders Common To Multiple Federal Agencies		
Alaska National Interest Lands Conservation Act (ANILCA) 16 USC 410hh-3233 43 USC 1602-1784 43 CFR 36	Title XI: SF 299 – Application for Transportation and Utility Systems and Facilities on Federal Lands. Transportation systems that are proposed to cross a conservation system unit (CSU) created or expanded by the ANILCA require an act of Congress if such a transportation system would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a right of way for the particular type of transportation system proposed, such as a natural gas pipeline across National Park Service units in Alaska. Section 906(k) requires state concurrence on selected lands prior to granting ROW. Title VIII: Section 810 – Federal agencies must evaluate and provide a proposed finding of effects of proposed development on subsistence.	Minimize impacts to CSUs through the approval or disapproval of transportation and utility system applications across public lands in Alaska. Provide the opportunity for rural Alaska residents to continue to engage in a subsistence way of life.
American Indian Religious Freedom Act of 1978 42 USC 1996	Federal agencies must consider protection of sites considered sacred to Native Americans.	Reaffirm Native Americans’ right to religious freedom, “including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.”

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Executive Memorandum of April 29, 1994, on Government-to-Government Relations with Native American Tribal Governments	Federal agencies must operate within a government-to-government relationship with federally recognized tribes; are tasked with consulting with potentially affected tribal governments prior to taking actions that affect federally recognized tribal governments; and must also evaluate the impact of Federal Government plans, projects, programs, and activities on tribal trust resources and assure that tribal government rights and concerns are considered during the development of such plans, projects programs, and activities.	Encourage government-to-government cooperation and consultation between the federal government and Native American tribal governments with regard to federal agency actions, activities, plans, projects and programs.
Executive Order 11514 – Protection and Enhancement of Environmental Quality	The EPA reviews and evaluates the Draft and Final EIS for compliance with Council on Environmental Quality (CEQ) guidelines.	This Executive Order details the responsibilities of federal agencies and the CEQ in directing their policies, plans, and programs to meet national environmental goals.
Executive Order 11988 – Floodplain Management	Federal agencies must establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for actions undertaken in a floodplain. Impacts to floodplains are to be avoided to the extent practicable.	Protect floodplains and manage risk from flooding.
Executive Order 11990 – Protection of Wetlands	Federal agencies must avoid short- and long-term adverse impacts to wetlands whenever a practicable alternative exists.	Protect wetlands.
Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Federal agencies must develop environmental justice (EJ) strategies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (including Native American tribes).	Protect the health and environment of minority and low-income populations.
Executive Order 13007 – Indian Sacred Sites	Federal agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.	Protect and accommodate access to Native American sites.
Executive Order 13112 – Invasive Species	Federal agencies are to prevent the introduction of invasive species, control those that are introduced, and provide for the restoration of native species.	Prevent the introduction of invasive species and provide for their control.
Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds	Federal agencies must avoid or minimize the impacts of their actions on migratory birds and take active steps to protect birds and their habitat.	Protect migratory bird habitat and populations.
Executive Order 13212 – Actions to Expedite Energy-Related Projects	Federal agencies must take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.	Increase production and transmission of energy in a safe and environmentally sound manner.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
National Environmental Policy Act (NEPA) 42 USC 4321	The NEPA of 1969 requires all federal agencies to prepare a detailed statement of the environmental effects of proposed federal actions that may significantly affect the quality of the human environment.	Protect the environment through procedures that ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken.
National Historic Preservation Act (NHPA) of 1966 16 USC 470 et seq.	Federal agencies are responsible for ensuring protection of historical, cultural, and archaeological sites and resources in areas where federal actions are taking place.	Ensure consideration of the values of historic properties in carrying out federal actions. Make efforts to identify and mitigate impacts to significant historic properties.
Native American Graves Protection and Repatriation Act 25 USC 3001	Discovery or disturbance of any human remains in the Project area must be accounted for and protected and/or properly returned to the tribe of origin.	Protect Native American sacred and grave sites.
Bureau of Land Management (BLM)		
Alaska Native Claims Settlement Act (ANCSA) 14 USC 33 1601-1629g	The BLM is responsible for consultation with Native Corporations on selected lands prior to granting a ROW, and for transfer of federal lands to Native corporations and villages.	The ANCSA established Alaska Native land entitlements.
Federal Land Policy and Management Act (FLPMA) 43 USC § 1732, and 43 CFR 2800	The BLM has the authority to grant permits and regulate the use, occupancy, and development of the public lands and to take whatever action is required to prevent unnecessary or undue degradation of the public lands.	Provide for multiple uses of public lands while protecting them from unnecessary or undue degradation.
National Trails Systems Act of 1968 16 USC 1241-1251	Requires the BLM to identify segments and sites for inclusion in National Historic Trail System; coordinate protection and/or improvement of Trail System, and liaison between land managers, private trail organizations, and trail managers by providing an information network.	The BLM is the statutorily-designated federal administrator for the INHT, and is the federal point-of-contact for INHT matters.
Rights of Way, under the Mineral Leasing Act 43 CFR 2880 Mineral Leasing Act of 1920	The BLM has the authority to approve a Federal Pipeline Grant of ROW and associated Temporary Use Permits (TUP) across federal lands.	Provide for mineral development on public lands while protecting them from unnecessary or undue degradation.
Wilderness Act of 1964 16 U.S.C. 1131 et seq.	The BLM documents information that constitutes and inventory finding on wilderness characteristics under the Secretary of Interior's Order 3310 of December 22, 2010.	The Wilderness Act of 1964 establishes definition of wilderness and is used in identifying lands with wilderness characteristics.
U.S. Army Corps of Engineers (USACE)		
Clean Water Act (CWA) of 1972 33 USC 1344	The USACE issues a Section 404 permit for discharge of dredged and fill material into U.S. waters, including wetlands.	Minimize impacts to waters of the United States, including wetlands, by regulating the discharge of dredged and/or fill material.
Rivers and Harbors Act of 1899 33 USC 403	The USACE issues Section 9 and Section 10 permits for structures or work in, or affecting, navigable waters of the U.S.	Prevent unauthorized obstruction or alteration (dam, dike, or other structure) of any navigable waters of the United States.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
U.S. Environmental Protection Agency (EPA)		
Clean Air Act of 1967, Amended 1977 (CAA) 42 USC 7401 et seq.	As oversight the EPA conducts a review and evaluation of the Draft and Final EIS as authorized by Section 309 of the CAA.	Protect and enhance the quality of the nation's air resources by controlling emissions of EPA-designated air pollutants by stationary and mobile sources. The EPA maintains oversight of the Alaska Department of Environmental Conservation's (ADEC's) implementation of the federal Prevention of Significant Deterioration (PSD) program through its state implementation plan.
Clean Water Act (CWA) of 1972, Amended 1977 33 USC 1251 et seq.	The National Pollutant Discharge Elimination System (NPDES) Permit program is administered under Section 402, Clean Water Act of 1972, as amended (CWA) for discharges of pollutants, including oil and gas, from a point source into waters of the United States. Through program delegation, the EPA oversees the ADEC's administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction. Authority for Oil and Gas facilities will be delegated on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility. Section 402 – NPDES Water Discharge Permit, AKG-33-0000 for hydrostatic testing and discharges of excavation, dewatering, and stormwater from temporary camps, or an individual permit covering these discharges could be issued. Section 311 – The EPA provides a Federal On-Scene Coordinator responsible for direction and monitoring of spills. The EPA also issues spill prevention, control, and countermeasure (SPCC) plan and facility response plan (FRP) approvals for storage of more than 1,320 gallons in aggregate in aboveground tanks with capacity of 55 gallons or more. Section 404 – The EPA reviews and comments on permit applications for compliance with Section 404(b)(1) guidelines and other statutes and authorities within their jurisdiction.	The purpose of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. It prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 402 establishes guidelines for effluent discharges from point-sources to the waters of the United States and for the NPDES permitting program. Section 311 establishes procedures, methods and equipment, and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines. The purpose of Section 404 is to minimize impacts to waters of the United States (including wetlands) by regulating the discharge of dredged and/or fill material.
Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act 42 USC 9601	The EPA implements facility reporting requirements to state and federal agencies for releases of hazardous substances in excess of specified amounts.	Protect public health and the environment from risks posed by uncontrolled hazardous waste sites.
Resource Conservation and Recovery Act of 1976 (RCRA) 42 USC 6901	The EPA develops and implements regulatory programs to manage hazardous waste from generation until ultimate disposal, including issuing an identification number for any entity that generates hazardous wastes.	The protection of human health and environment from the potential hazards of waste disposal, conservation of energy and natural resources, waste reduction, and environmentally sound waste management.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Toxic Substances Control Act 15 USC 2601	The EPA develops and implements regulatory requirements for the testing of new and existing chemical substances and regulates the treatment, storage, and disposal of certain toxic substances.	The protection of human health and the environment from hazardous chemicals.
U.S. Coast Guard (USCG)		
Rivers and Harbors Act of 1899 33 USC 403	The USCG approves construction of a bridge across navigable waters to ensure safe navigability of waterways.	Prevent unauthorized obstruction or alteration (dam, dike, or other structure) of any navigable waters of the United States.
U.S. Department of Transportation, Pipeline Hazardous Materials Safety Administration (USDOT, PHMSA)		
Pipeline Safety Regulations Title 49 CFR Parts 190-199 Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006 Public Law 109-468 The Pipeline Safety Statute 49 USC 60101-60301	Pipeline transportation and pipeline facilities must meet the minimum safety standards as regulated and enforced by the USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA).	To enable the USDOT PHMSA to achieve and maintain pipeline safety. To provide for enhanced safety and environmental protection in pipeline transportation, and to provide for enhanced reliability in the transportation of the Nation's energy products by pipeline. To provide adequate protection against risks to life and property posed by pipeline transportation and pipeline facilities by improving the regulatory and enforcement authority of the Secretary of Transportation.
Hazardous Materials Transportation Act 49 USC 1801-1819	Hazardous materials must be transported according to USDOT regulations.	The Secretary of Transportation must protect the nation adequately against risks to life and property that are inherent in the transportation of hazardous materials.
U.S. Fish and Wildlife Service (USFWS)		
Fish and Wildlife Coordination Act (FWCA) 16 USC 661 et seq. FWCA of 1980 16 USC 2901	The USFWS provides consultation on effects to fish and wildlife resources. The USFWS consults with the state agency responsible for fish and wildlife resources to conserve or improve wildlife resources.	Ensure that fish and wildlife resources receive equal consideration to other project features. Conserve and promote conservation of non-game fish and wildlife species and their habitats.
Bald and Golden Eagle Protection Act 16 USC 668	The USFWS permits relocation of bald and golden eagle nests that interfere with resource development or recovery operations.	Protect bald eagle populations.
Marine Mammal Protection Act (MMPA) 16 USC 1361-1407	The USFWS issues a Letter of Authorization for incidental takes of marine mammals including polar bear and walrus.	Ensure that marine mammal populations are maintained at, or in some cases restored to, healthy population levels.
Migratory Bird Treaty Act (MBTA) 16 USC 703	The USFWS implements provisions of the Migratory Bird Treaty Act.	Protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia.
Endangered Species Act of 1973 (ESA) 16 USC 1531	The USFWS provides consultation on effects to threatened or endangered species, and to designated critical habitat, and issues incidental take authorizations.	Protect wildlife, fish, and plant species in danger of becoming extinct, and conserve the ecosystems on which endangered and threatened species depend.
National Oceanic and Atmospheric Administration (NOAA) Fisheries		
Fish and Wildlife Coordination Act 16 USC 661 et seq.	The NOAA Fisheries (NMFS) provides consultation regarding effects on marine fish and wildlife resources.	Ensure that fish and wildlife resources receive equal consideration to other project features.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Magnuson-Stevens Fishery Management and Conservation Act 16 USC 1801-1883	The NOAA Fisheries provides consultation on the effects on Essential Fish Habitat. Essential Fish Habitat includes habitats necessary to a species for spawning, breeding, feeding, or growth to maturity.	Protect fish habitats and populations.
Marine Mammal Protection Act 16 USC 1361-1407	The NOAA Fisheries provides consultation regarding effects on marine mammals. The NOAA Fisheries issues Incidental Harassment Authorization under the Marine Mammal Protection Act (MMPA) for incidental takes of certain protected marine mammals (ringed seals, bowhead whales, etc.).	Ensure that marine mammal populations are maintained at, or in some cases restored to, healthy population levels.
The Endangered Species Act of 1973 16 USC 1531	The NOAA Fisheries provides consultation on effects to threatened or endangered species, and to designated critical habitat, and issues incidental take authorizations.	Protect certain species of marine mammals and fish in danger of becoming extinct, and conservation of the ecosystems on which endangered and threatened species depend.
National Park Service (NPS)		
National Park Service Organic Act 39 Stat. 535, 16 U.S.C. 1 et seq., as amended	The NPS has the authority to grant permits and regulate the use of public lands and to take whatever action is required to prevent unnecessary or undue degradation of these lands.	Promote and regulate the use of the national parks, monuments, and reservations for the purpose of conserving the scenery, natural and historic objects, and wildlife and to provide for the enjoyment of these lands in a manner that will leave them unimpaired for the enjoyment of future generations.
Section 6(f) of the Land and Water Conservation Fund (LWCF) 16 U.S.C 4601 et seq.	Prohibits the conversion of property acquired or developed with LWCF grants to a non-recreational purpose without the approval of the NPS.	Assures that replacement lands of equal value, location and usefulness are provided as conditions to approval of conversion of lands acquired with LWCF funds.
U.S. Department of the Treasury		
Treasury Department Order No. 120-1	The U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms requires that applicants obtain a Permit to Purchase Explosives for Blasting prior to the purchase, storage, and use of explosives for conducting blasting activities.	Regulates blasting activities to ensure public safety.
State		
Alaska Department of Environmental Conservation (ADEC)		
Clean Air Act of 1967, Amended 1977 42 USC 7401 et seq. (CAA) Air Quality Control 18 AAC 50 et seq.	The ADEC issues Air Quality Control permits to construct and to operate. The ADEC issues Title V Operating permits and prevention of significant deterioration (PSD) permits for air pollutant emissions under the CAA Amendments (Title V).	Identify, prevent, abate, and control air pollution in a manner that meets the purposes of AS 46.03, AS 46.14, and 42 U.S.C. 7401 - 7671q (CAA).
Clean Water Act of 1972, Amended 1977 33 USC 1251 et seq.	Section 401 – Requires the ADEC to certify that federal permits meet standards set by the Water Quality Standards program. The ADEC reviews and approves Storm Water Discharge Pollution Prevention Plans.	Establishes guidelines for effluent discharges from non-point sources to the waters of the United States and the NPDES permitting program.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Clean Water Act of 1972, Amended 1977 33 USC 1251 Wastewater Disposal 18 AAC 72 Alaska Pollutant Discharge Elimination System 18 AAC 83 Water Quality Standards 18 AAC 70 Drinking Water Standards 18 AAC 72	The ADEC provides approval for domestic wastewater collection, treatment, and disposal plans for domestic wastewaters. The ADEC requires a permit for disposal of domestic and non-domestic wastewater. The ADEC is fully authorized to administer the EPA's NPDES program through the Alaska Pollutant Discharge Elimination System (APDES). Existing regulations at 18 AAC 15 and 18 AAC 72 were amended to comply with the Clean Water Act. The ADEC provides approval for treatment and disposal plans for industrial wastewaters.	Regulation of discharges to protect water quality. On October 31, 2008, the EPA formally approved the state's NPDES Program application. The state's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting and compliance and enforcement programs is being transferred to the ADEC over four years. Oil and Gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
Resources Conservation and Recovery Act of 1976 42 USC 6901 18 AAC 60.430. – AS 46.03.005, 010 Permit Application 18 AAC 60.210-.215	The ADEC reviews and approves solid waste processing and temporary storage facilities plans for handling and temporary storage of solid waste on state lands. The ADEC reviews permits for solid waste landfills on state lands.	The protection of human health and environment from the potential hazards of waste disposal, conservation of energy and natural resources, waste reduction, and environmentally sound waste management.
Permit and Registration Requirements 18 AAC 31.020	The ADEC may issue permits for persons seeking to operate a food establishment.	Protect public health through the regulation of food establishments.
System Classification and Plan Approval 18 AAC 80.200	The ADEC may issue approval of drinking water plans.	Protect public health through regulating the provision of drinking water.
Open Burning 18 AAC 50.065	The ADEC enforces air quality requirements for open burning, and requires a permit for controlled open burning of forest land, vegetative cover, fisheries, or wildlife habitat in excess of 40 acres annually.	Protect public health through the regulation of open burning.
Oil and Hazardous Substances Pollution Control Regulations 18 AAC 75 AS 46.04.040, AS 46.04.050	The ADEC requires natural gas production and terminal facilities having an effective aboveground or belowground storage capacity of greater than 10,000 barrels (420,000 gallons) of refined petroleum products to prepare an Oil Discharge Prevention and Contingency Plan and provide Proof of Financial Responsibility.	Protect public health through regulation of the storage of refined petroleum products by ensuring the ability of the facility owner or operator to respond to and address the damages cause by a spill.
Alaska Department of Fish and Game (ADF&G)		
The Fish and Wildlife Conservation Act of 1980 16 USC 2901 The Fish and Wildlife Conservation Act of 1980 16 USC 661 et seq.	The ADF&G consults with the USFWS about fish and wildlife resources to conserve or improve wildlife resources. The ADF&G provides comments and recommendations to federal agencies pursuant to the FWCA.	Conserve and promote conservation of non-game fish and wildlife species and their habitats. Ensure that fish and wildlife resources receive equal consideration to other project features.
Anadromous Fish Act AS 16.05.871 Fishway Act AS 16.05.841	An individual or governmental agency notifies and obtains authorization from the ADF&G for activities that could use, divert, obstruct, pollute, or change natural flow of specified anadromous fish streams.	Protect the integrity of the various rivers, lakes, and streams or parts of them that are important for the spawning, rearing, or migration of anadromous fish.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Activities Requiring a Special Area Permit 5 AAC 95.420	A special area permit must be obtained from the ADF&G for activities (except for lawful hunting, trapping, fishing, viewing, and photography) occurring in state game refuges, state recreation areas, across designated wild and scenic rivers, or through state parks.	Prevent significant effects to vegetation, drainage, water quality, soil stability, fish, wildlife, or their habitats.
License, Permit, and Tag Fees; Surcharge; Miscellaneous Permits to Take Fish and Game AS 16.05.340	The ADF&G may issue a permit to collect fish and game, subject to limitations and provisions that are appropriate, for a scientific, propagative, or educational purpose.	To permit and regulate the collection of fish and game.
Permit for Scientific, Educational, Propagative, or Public Safety Purposes 5 AAC 92.033	The ADF&G may issue a permit for the taking, possessing, importing, or exporting of game for scientific, educational, propagative, or public safety purposes.	To permit and regulate the collection of game.
	Alaska Department of Natural Resources (ADNR)	
Alaska Historic Preservation Act AS 41.35.010 to .240 NHPA of 1966 16 U.S.C 470 et seq. 36 CFR 800 Sections 106 and 110 The Archeological Resources Protection Act of 1979 16 USC 470	Section 106 of the NHPA requires consultation with the Alaska State Historic Preservation Office (SHPO) and, when there are effects on cultural resources listed on or eligible for inclusion in the National Register of Historic Places (NRHP), with the President's Advisory Council on Historic Preservation. The SHPO issues a Field Archaeology Permit for archaeological fieldwork on state lands. The SHPO would also be consulted by the USACE. The ADNR Office of History and Archeology (OHA) issues a Cultural Resources Concurrence for developments that may affect historic or archaeological sites.	Protect cultural and archaeological resources to ensure consideration of the values of historic properties in carrying out federal activities and to make efforts to identify and mitigate impacts to significant historic properties. The Archeological Resources Protection Act secures the protection of archaeological resources and sites on public and Native American lands and encourages the exchange of information between involved individuals and entities.
Public Land Act Material Sales AS 38.05.110 Permits AS 38.05.850 Mining Sites Reclamation Plan Approvals AS 27.19	The ADNR issues a Material Sales Contract for mining and purchase of gravel from state lands. The ADNR issues Right-of-Way (ROW) and Land Use permits for use of state land, ice road construction on state land, and state waters. The ADNR approves mining reclamation plans on state, federal, municipal, and private land and water.	Manage use of Alaska's land and water resources.
Right of Way (ROW) Leasing Act AS 38.35.020	The ADNR State Pipeline Coordinator's Office issues pipeline ROW leases for pipeline construction and operation across state lands. The ADNR Commissioner signs the leases and the State Pipeline Coordinator manages the leases.	Manage use of Alaska's land and water resources.
Water Use AS 46.15	The ADNR issues a Temporary Water Use Permit for water use necessary for construction and operations. The ADNR issues a Water Rights Permit for appropriation of a significant amount of water on other than a temporary basis.	Manage use of Alaska's land and water resources.
Duties and Powers of Department of Natural Resources, Limitations AS 41.21.020 Section 6(f) of the Land and Water Conservation Fund (LWCF) 16 U.S.C 4601 et seq.	The ADNR has the responsibility for outdoor recreation planning and administering the LWCF program within Alaska.	Assures that replacement lands of equal value, location and usefulness are provided as conditions to approval of conversion of lands acquired with LWCF funds.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Alaska Department of Public Safety (ADPS), Division of Fire and Life Safety		
General function of the Department of Public Safety with respect to fire protection. AS 18.70.010 Alaska Fire and Life Safety Regulations 13 AAC 50-55	The Division of Fire and Life Safety has statewide jurisdiction for fire code enforcement and plan review authority except in communities which have received deferrals which include the Municipality of Anchorage, Fairbanks, University of Alaska Fairbanks, and Wasilla/Lakes.	To prevent the loss of life and property from fire and explosion through plan review and approval prior to construction, repair, remodel, addition, or change of occupancy of any building/structure, or installation or change of fuel tank(s).
Alaska Department of Transportation and Public Facilities (ADOT&PF)		
Chapter 25 Operations, Wheeled Vehicles: Oversize and Overweight Vehicles 17 AAC 25.300	The ADOT&PF issues permits for oversize or overweight vehicles.	To protect Alaska's highway investments by regulating the transport of oversize and overweight loads on Alaska highways.
Chapter 25 Operations, Wheeled Vehicles: Transportation of Hazardous Materials, Hazardous Substances, or Hazardous Waste 17 AAC 25.200	The ADOT&PF regulates the transportation of hazardous materials, hazardous substances, or hazardous waste by vehicles.	To ensure compliance at the State level with the Hazardous Materials Transportation Act (49 USC 1801-1819); to protect the State adequately against risks to life and property that are inherent in the transportation of hazardous materials.
Utility Permits 17 AAC 15.011	The ADOT&PF issues permits authorizing the applicant to construct or install utility facilities within a department right-of-way.	Protect the public interest by ensuring that utility facilities do not adversely affect the design, construction, maintenance, safety, or operation of highways within the State.
Alaska Railroad Corporation (ARRC)		
Alaska Railroad Corporation Act of 1984 AS 42.40.10 et seq.	The ARRC requires developers to obtain a permit from the ARRC prior to use of ARRC-owned lands.	The Act created the ARRC as a self-sustaining, State-owned corporation. ARRC has the authority to support its operations by generating revenue from freight, passenger and real estate services.
Alaska Division of Homeland Security & Emergency Management (DHS&EM)		
Hazardous Chemicals, Materials, and Wastes AS 29.35.500	The State Emergency Response Commission (SERC) enforces reporting and planning requirements for facilities that handle, store, and/or manufacture hazardous materials.	To implement the Superfund Amendments and Reauthorization Act at the state and local levels in order to support emergency response planning and community right-to-know relative to hazardous materials.
Local		
North Slope Borough (NSB)		
North Star Borough Land Management Regulations (NSBMC §§ 19.10.010 – 19.70.060)	The NSB requires compliance with its zoning and permitting ordinances and issues permits for development, uses, and activities on land within the NSB.	The NSB regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of NSB residents and to ensure compliance with environmental policies of local concern.
Fairbanks North Star Borough (FNSB)		
Fairbanks North Star Borough Title 18 Zoning Code (§§18.02-18.58)	The FNSB requires compliance with its zoning code. The borough requires that an approved zoning permit be acquired prior to any excavation, construction, relocation, or installation for a new land use.	The FNSB regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of FNSB residents and to ensure compliance with environmental policies of local concern.

TABLE 1.6-1 Authorities Applying to the Proposed Action

Legal Authority	Authorizations	Regulatory Intent
Denali Borough (DB)		
Denali Borough Title 9 Land Use Code (§§9.05.10 -9.25)	The Denali Borough requires compliance with its Land Use Code, which includes the Comprehensive Land Use Plan, zoning code, and gas exploration and development ordinance (Chapter 9.25.010).	The Denali Borough regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of Denali Borough residents and to ensure compliance with environmental policies of local concern.
Matanuska-Susitna (Mat-Su) Borough		
Mat-Su Borough Title 17 Zoning (§§17.01-17.125)	The Mat-Su Borough requires compliance with its zoning code. All land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit.	The Mat-Su Borough regulates land uses and activities within the borough to provide for the protection of the health, safety, and welfare of Mat-Su Borough residents and to ensure compliance with environmental policies of local concern.
City of Nenana		
Land Use Permit	Development within the City requires mayoral approval of a Land Use Permit.	The City of Nenana maintains oversight over development within the City.

1.7 REFERENCES

AGDC. See Alaska Gasline Development Corporation.

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2.0 PROJECT DESCRIPTION

2.1 PROPOSED FACILITIES AND LAND REQUIREMENTS

2.1.1 Pipeline Facilities

The Alaska Gasline Development Corporation (AGDC, the Applicant) proposes to construct, operate, and maintain approximately 737 miles of new 24-inch-diameter intrastate natural gas transmission pipeline (Mainline), approximately 34 miles of new 12-inch-diameter pipeline lateral (Fairbanks Lateral), one or two standalone compressor stations (CS), a gas conditioning facility (GCF), a straddle and off-take facility, the Cook Inlet Natural Gas Liquid Extraction Plant (NGLEP) Facility, 3 meter stations, 37 mainline valves, 5 pig[1] launcher and/or receiver facilities, and other permanent facilities. The proposed Project would extend from a point near Prudhoe Bay in the North Slope Borough (NSB) south to the Matanuska-Susitna (Mat-Su) Borough near Cook Inlet. The general location of the proposed Project facilities is shown in Figure 1.0-1. The Fairbanks Lateral would diverge from the proposed mainline and extend through Yukon-Koyukuk Census Area (YKCA) and Fairbanks North Star Borough (FNSB). The proposed Project would connect with Central Gas Facility (CGF) near Prudhoe Bay, to the Fairbanks natural gas distribution system, and to ENSTAR Natural Gas Company's (ENSTAR) pipeline system. Additional information regarding the transportation of gas between the Prudhoe Bay CGF and the proposed pipeline can be found in Section 3, Connected Actions.

The AGDC anticipates that initial Project natural gas flow would be less than 250 million standard cubic feet per day (MMscfd), but a peak capacity of 500 MMscfd has been proposed to meet anticipated future demands. The design capacity of the Fairbanks Lateral would be approximately 60 MMscfd.

In this Environmental Impact Statement (EIS), the locations of specific features along the proposed mainline pipeline route, such as proposed Project facilities and environmental resources, are identified by Mile Post (MP). Similarly, the locations of specific features along the proposed Fairbanks Lateral Route are identified by MP Fairbanks Lateral (FL). Further, the analysis contained in Section 5 of this EIS is presented for each of four proposed Project segments. Table 2.1-1 provides the location, MP, borough, and length information for the pipeline facilities associated with each of the proposed Project segments. Maps depicting the entire route of the proposed Project can be found at www.agdc.us/overview/map.

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[1] A pig is a mechanical tool used to clean and/or inspect the interior of a pipeline.

TABLE 2.1-1 Pipeline Crossing Lengths for the Proposed Project

Segment	Boroughs/Census Area	Milepost (MP)		Length (miles)
		Begin	End	
Mainline				
GCF to MP 540	North Slope	0	186.8	186.8
	Yukon-Koyukuk	186.8	490.5	303.7
	Denali	490.5	540.0	49.5
Segment Subtotal				**540.0**
MP 540 to MP 555	Denali	540.0	555.0	15.0
Segment Subtotal				**15.0**
MP 555 to End	Denali	555.0	575.6	20.6
	Matanuska-Susitna	575.6	736.4	160.8
Segment Subtotal				**181.4**
Mainline Total				**736.4**
Fairbanks Lateral (FL)				
	Yukon-Koyukuk	0	4.8	4.8
	Fairbanks North Star	4.8	34.4	29.6
Lateral Total				**34.4**
Project Total				**770.8**

[a] The segment through the Denali Borough is broken into two segments so the Denali National Park Route Variation and the segment it would replace may be evaluated and compared separate from one another. A description of the Denali National Park Route Variation is located in Section 4.0.

2.1.2 Aboveground Facilities

The AGDC proposes to construct and operate a GCF, at least one stand alone natural gas-fired compressor station, a straddle and off-take facility near Fairbanks, the Cook Inlet NGLEP Facility, meter stations, mainline valves (MLVs), and pig launcher/pig receiver facilities. Figures 2.1-1 through 2.1-4 depict locations and typical layouts for the GCF (Figures 2.1-1a and b); the stand-alone compressor stations (Figures 2.1-2a, b, and c); the straddle and off-take facility (Figures 2.1-3a and b); and the Cook Inlet NGLEP Facility (Figures 2.1-4a and b). A typical block valve is depicted in Figure 2.1-5 and a typical pig launcher and pig receiver facility are depicted in Figure 2.1-6.

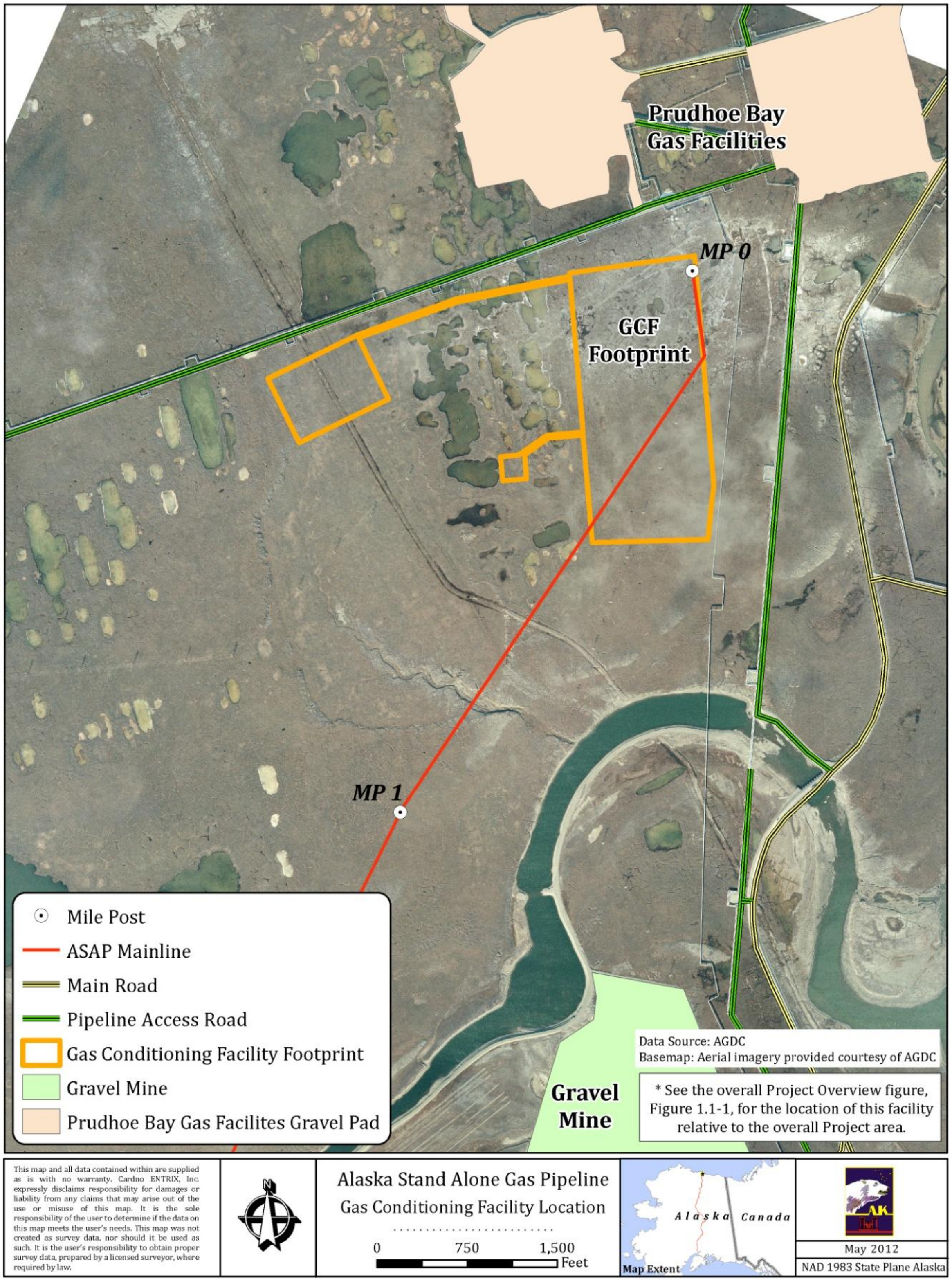


FIGURE 2.1-1a Typical GCF Facility Location

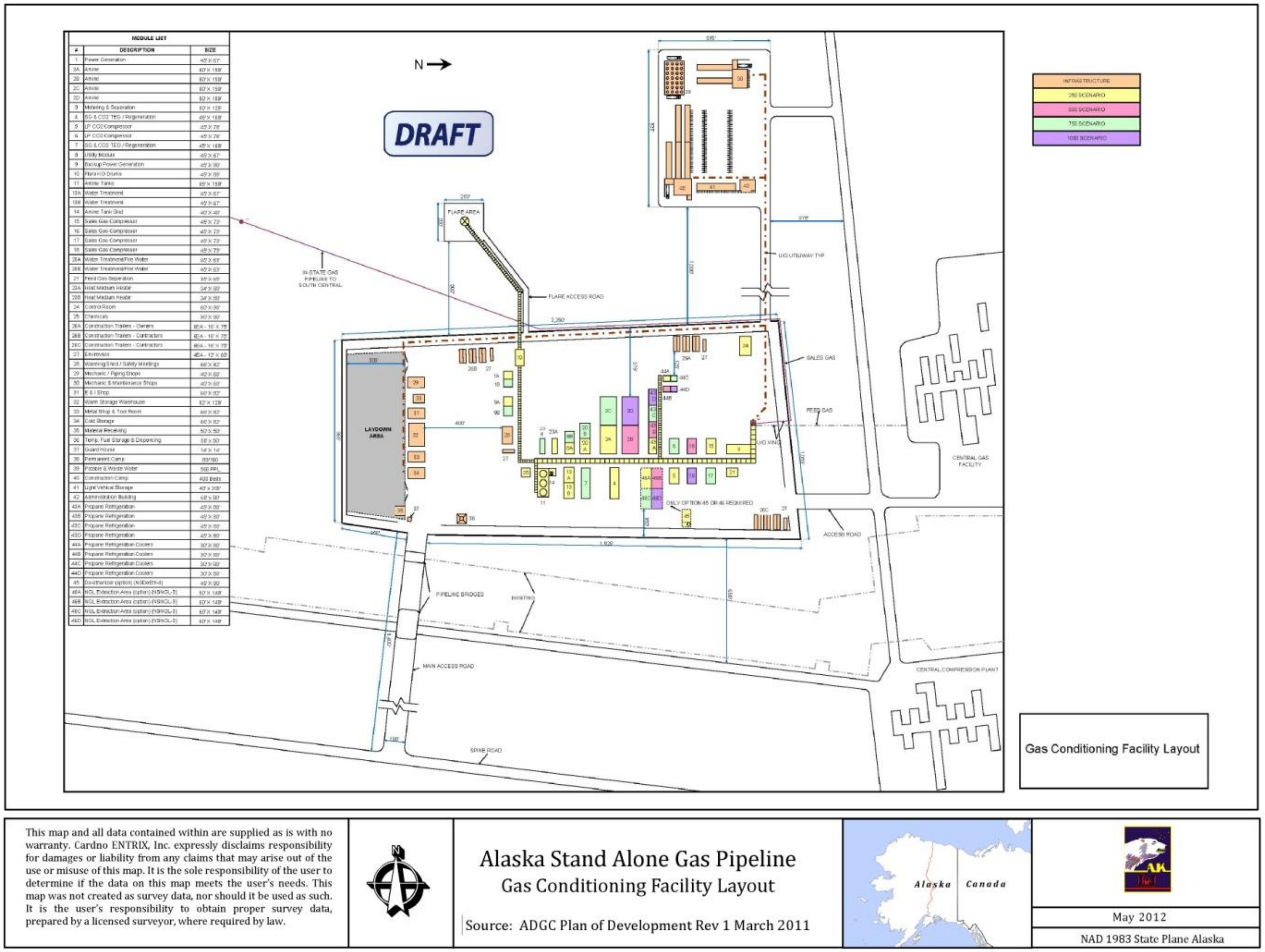


FIGURE 2.1-1b Typical GCF Facility Layout

FIGURE 2.1-2a Location of Stand-Alone Compressor Station 1

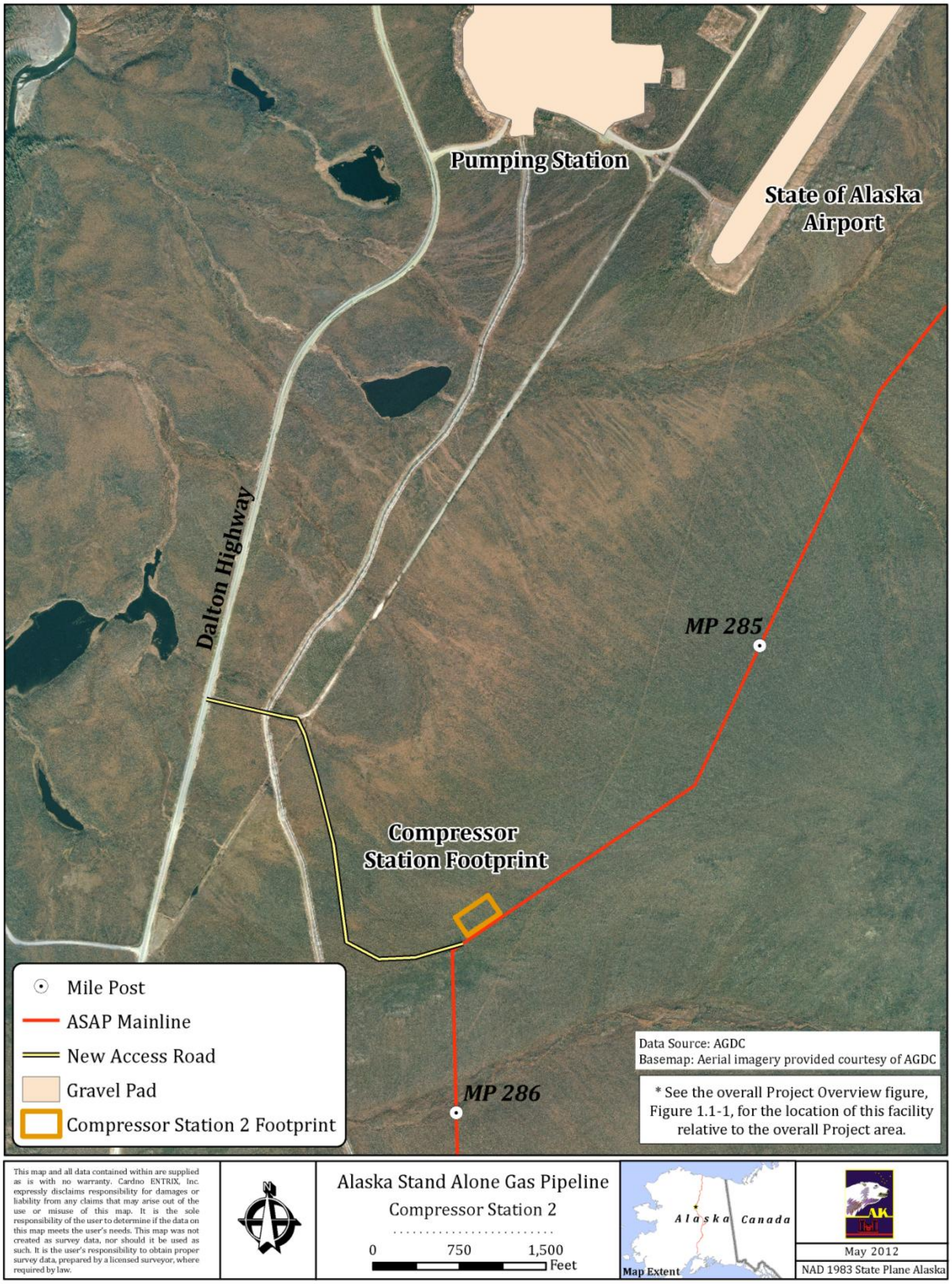


FIGURE 2.1-2b Location of Stand-Alone Compressor Station 2

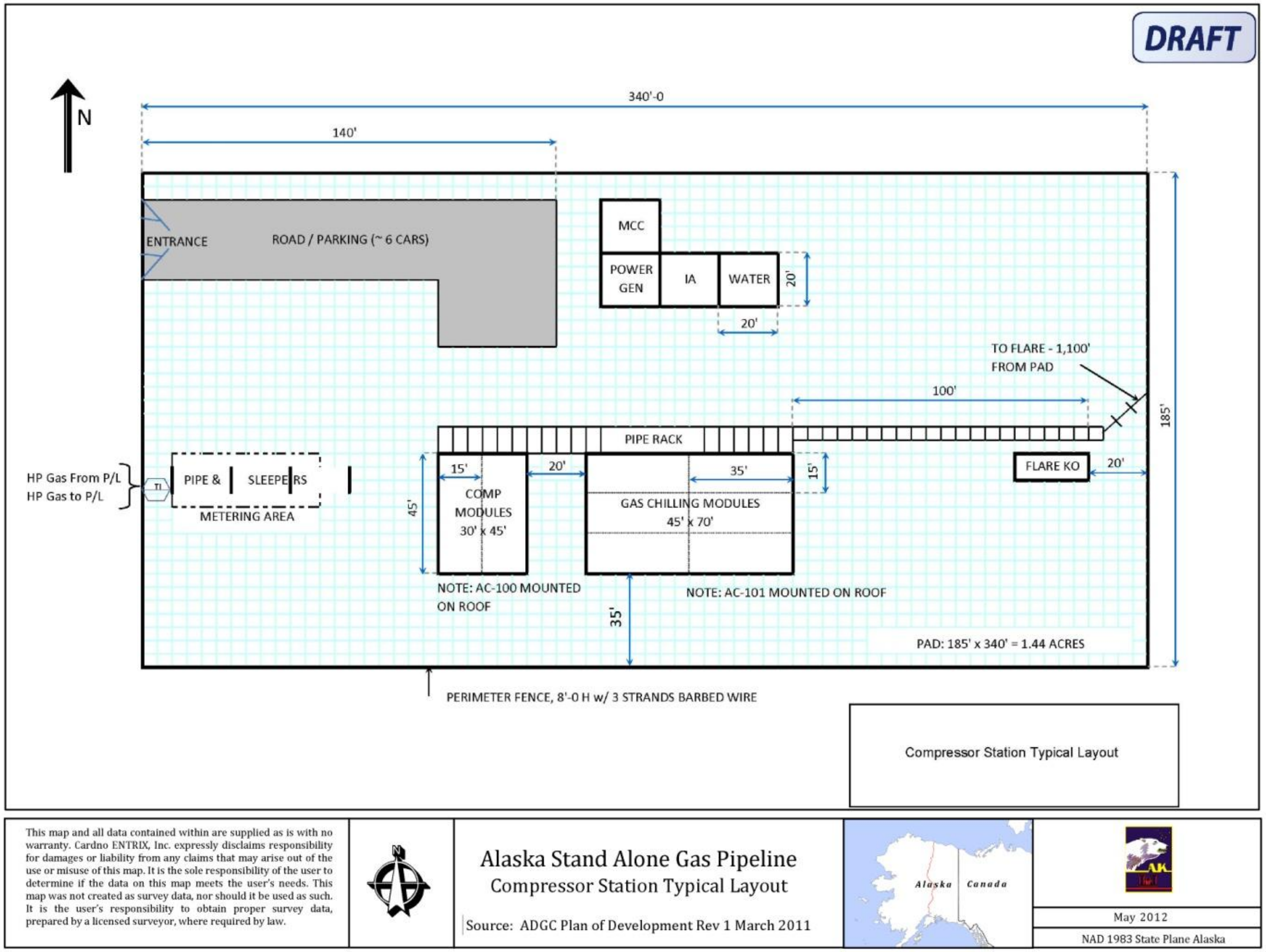


FIGURE 2.1-2c Typical Layout of Stand-Alone Compressor Station

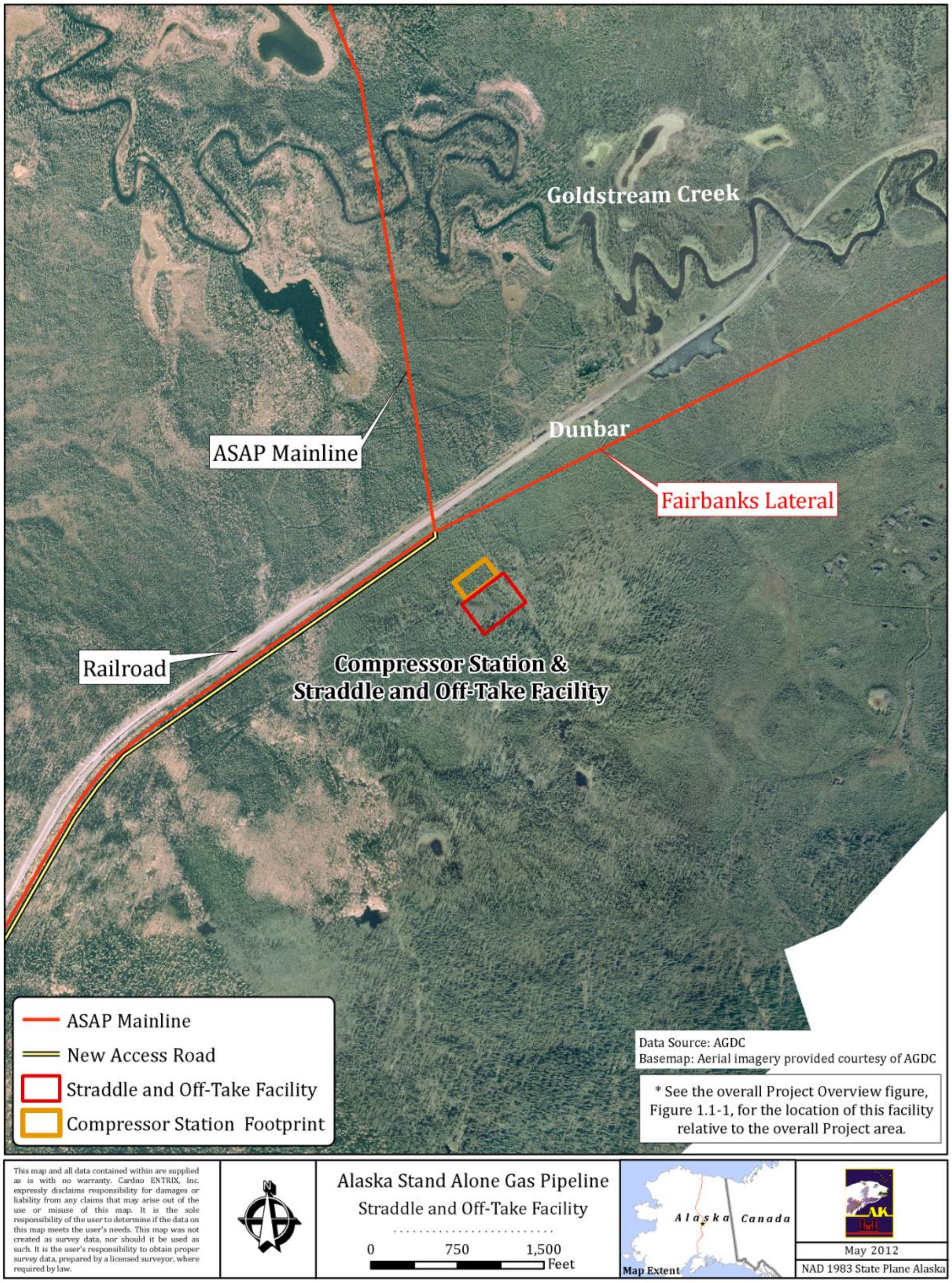
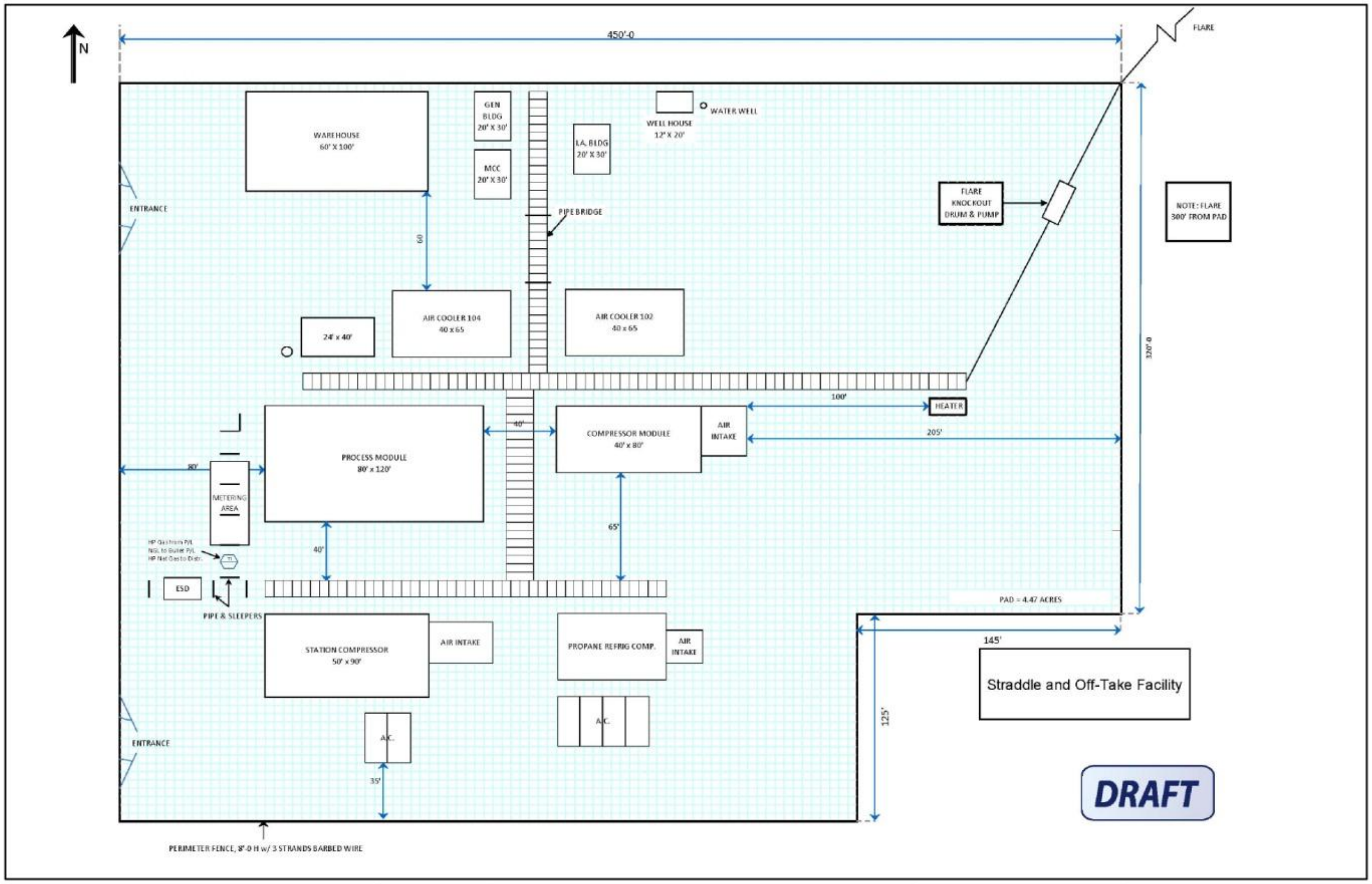


FIGURE 2.1-3a Location of Straddle and Off-Take Facility



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Alaska Stand Alone Gas Pipeline

Straddle and Off-Take Facility Layout

Source: ADGC Plan of Development Rev 1 March 2011

May 2012

NAD 1983 State Plane Alaska

FIGURE 2.1-3b Typical Layout of Straddle and Off-Take Facility

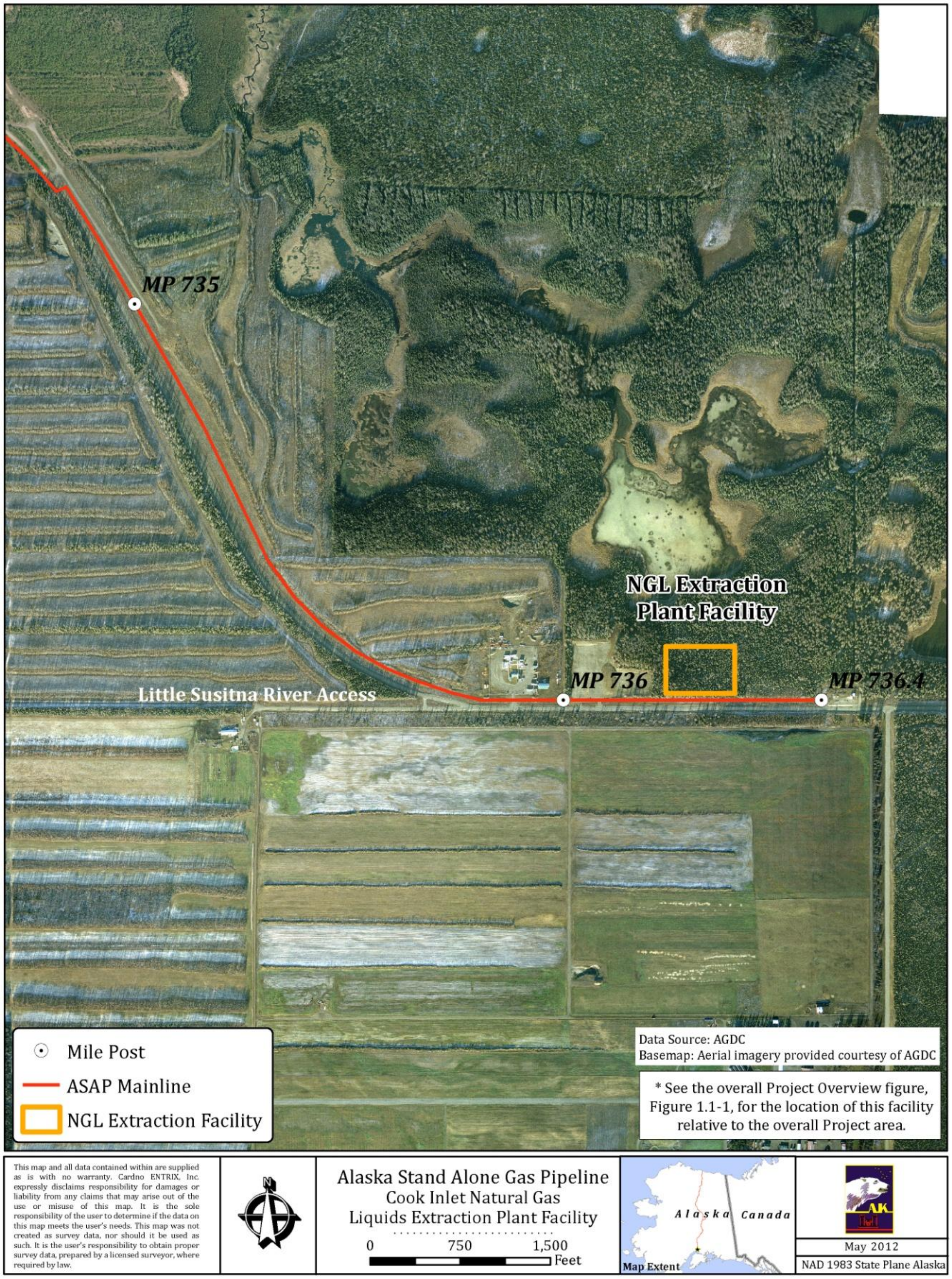


FIGURE 2.1-4a Location of Cook Inlet NGLEP Facility

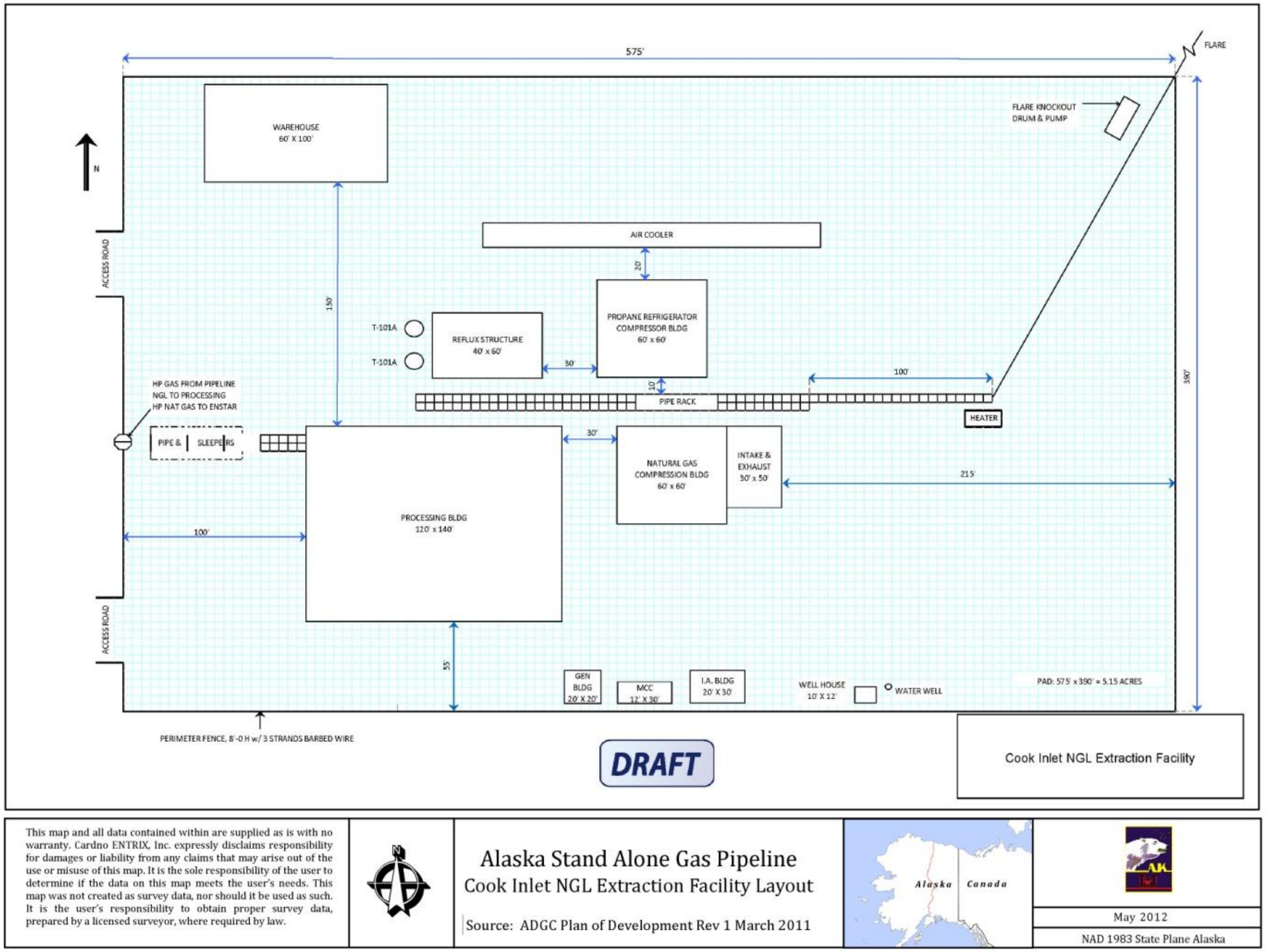


FIGURE 2.1-4b Typical Layout of Cook Inlet NGLEP Facility

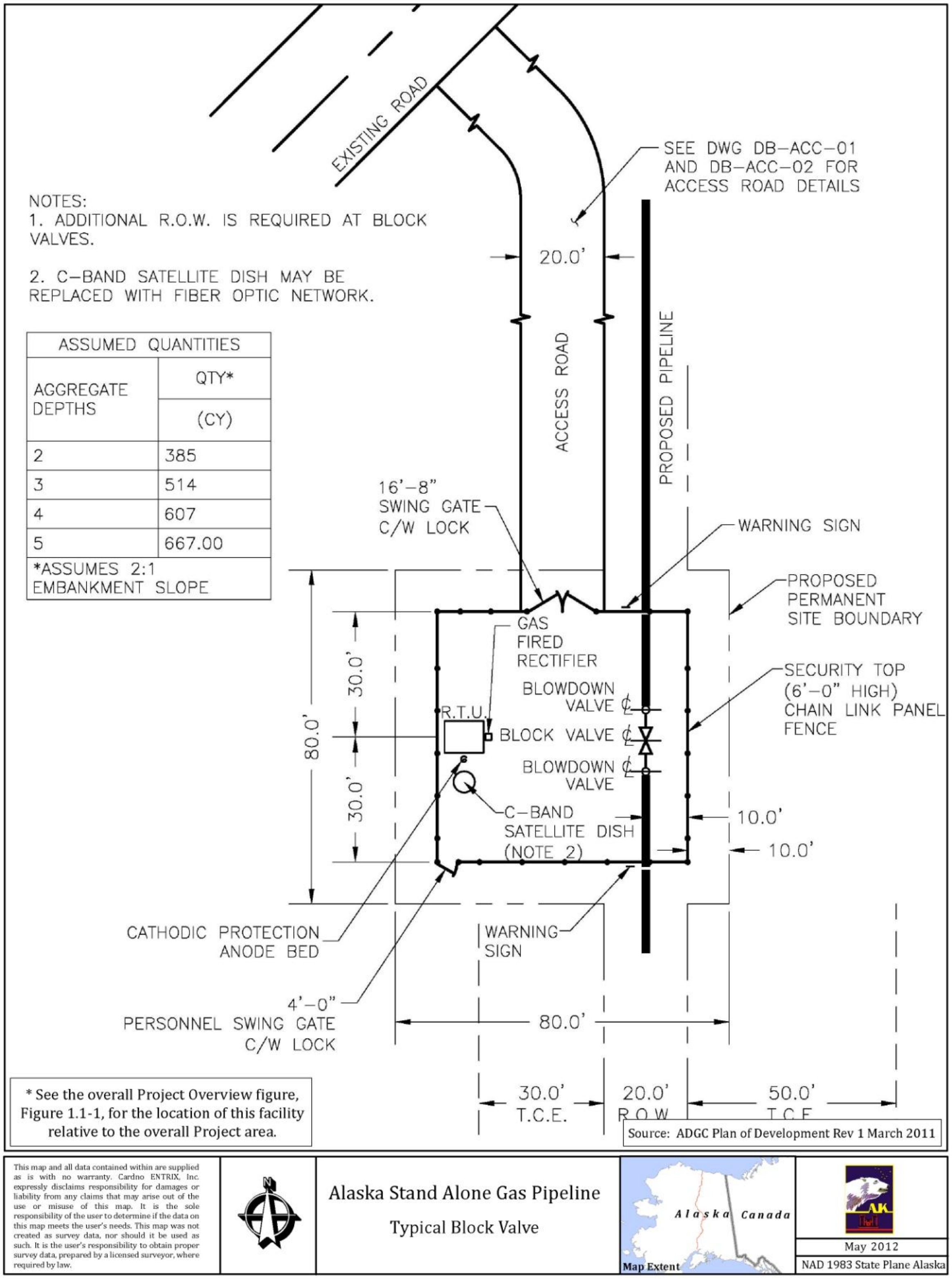


FIGURE 2.1-5 Typical Block Valve

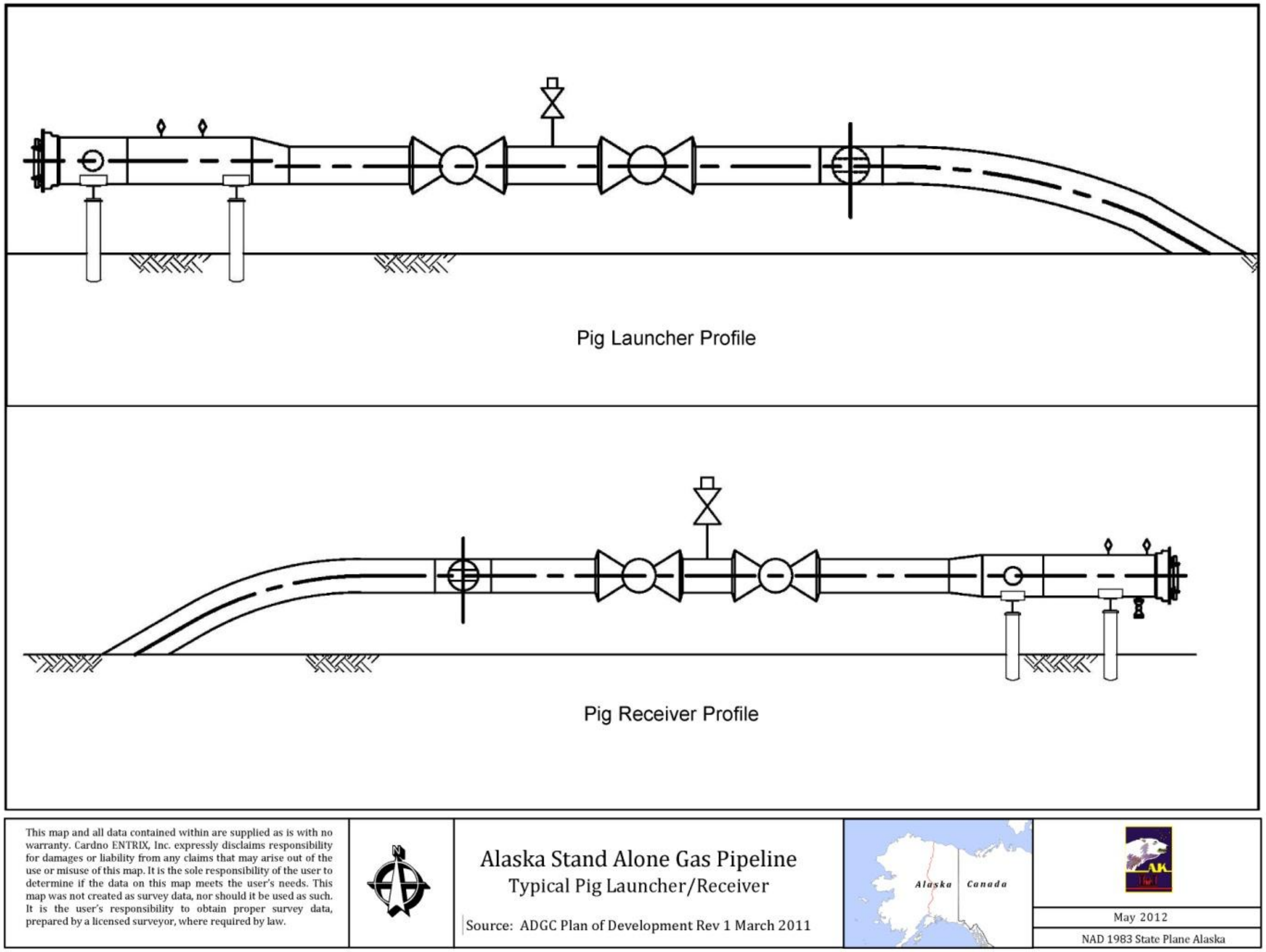


FIGURE 2.1-6 Typical Pig Launcher and Receiver Profiles

MLVs would be located at intervals no greater than 20 miles. Approximately 37 MLVs would be necessary to accommodate this spacing requirement. However, the specific locations of MLVs would be determined during the pipeline design process. Table 2.1-2 contains the locations for these facilities. Approximate land requirements are described in Section 2.1.3 below and summarized in Table 2.1-3.

TABLE 2.1-2 Aboveground Facilities for the Proposed Project

Type of Facility	Facility ID Number or Name	Borough/Census Area	MP	Project Segment
GCF		North Slope	MP 0.0	GCF to MP 540
Compressor Stations (CS)	GCF Compressor	North Slope	MP 0.0	GCF to MP 540
	CS 1[a]	Yukon-Koyukuk	MP 225.1	GCF to MP 540
	CS 2[a]	Yukon-Koyukuk	MP 285.6	GCF to MP 540
	CS 3/Straddle and Off-Take Facility Compressor[a, b]	Yukon-Koyukuk	MP 458.1	GCF to MP 540
	Cook Inlet NGLEP Facility Compressor	Matanuska-Susitna	MP 736.4	MP 555 to End
Straddle and Off-Take Facility[b]		Yukon-Koyukuk	MP 458.1	GCF to MP 540
NGL Extraction Facility	Cook Inlet NGLEP Facility	Matanuska-Susitna	MP 736.4	MP 555 to End
Meter station		North Slope	MP 0.0	GCF to MP 540
		Yukon-Koyukuk	MP 458.1	GCF to MP 540
		Matanuska-Susitna	MP 736.4	MP 555 to End
Pig Launcher/Receiver	Pig launcher	North Slope	MP 0.0	GCF to MP 540
	Pig launcher / Receiver[c]	Yukon-Koyukuk	MP 225.1	GCF to MP 540
	Pig launcher / Receiver [c]	Yukon-Koyukuk	MP 285.6	GCF to MP 540
	Pig launcher	Yukon-Koyukuk	MP 458.1	GCF to MP 540
	Pig receiver	Fairbanks North Star	MP FL 34.4	Fairbanks Lateral
	Pig receiver	Matanuska-Susitna	MP 736.4	MP 555 to End

Notes: MP = Milepost

[a] Under the one mainline compressor scenario, AGDC would install CS 2, under the 2 mainline compressor station scenario, AGDC would install 2 compressor stations: CS 1 and CS3. CS 3 would be collocated with the straddle and off-take facility.

[b] Facility would be located within the footprint of another aboveground facility; therefore, the potential impact acreage is accounted for within the larger facility footprint.

[c] Pig launchers/receivers would be installed at all major aboveground facilities; therefore, pig launchers/receivers would be installed at CS 1 or CS 2, depending on required compression.

TABLE 2.1-3 Locations and Land Requirements for the Proposed Project

Project Component	Construction Footprint (acres)	Operational Footprint (acres)
Mainline Pipeline Right-of-Way (ROW)	9,508[a]	3,314.6[b]
Temporary Extra Work Spaces (TEWS)	518.3	0
Fairbanks Lateral (ROW)	417.2[a]	125.2[b]
Compressor Stations[c]	1.4	1.4
Gas Conditioning Facility	68.7	68.7
Cook Inlet NGLEP Facility	5.2	5.2
Straddle and Off-Take Facility	3.3	3.3
Meter stations	0.0[d]	0.0[d]
Mainline valves[e,f]	0.8	2.4
Pig Launcher/Receiver	0.0[d]	0.0[d]
Pipe storage, rail, and contractor yards	182.7	0.0
Construction Camps	126.5	0.0
Access roads[e,g]	647.7	628
Total	**11,480**	**4,148.7**

[a] Acreage calculations are based on an offset 100-foot-wide ROW (40 foot on the western side and 60 foot on the eastern side of the centerline).
[b] Mainline pipeline operational footprint calculations are based on a 52-foot-wide ROW on federal lands and a 30-foot-wide ROW on private and state lands. Fairbanks Lateral operational footprint calculations are based on a 30-foot-wide ROW on private and state lands (there are no federal lands along the Fairbanks Lateral).
[c] Acreages for compressor stations are only depicted for those compressor stations not collocated with other aboveground facilities. Under the one mainline compressor scenario, the AGDC would install CS 2; under the two mainline compressor station scenario, the AGDC would install 2 compressor stations: CS 1 and CS 3. CS 3 would be collocated with the straddle and off-take facility. As only one standalone compressor station would occur under each scenario, the cumulative impact would be the same for either facility.
[d] All pig launcher and/or receiver facilities would be collocated with other facilities. Land encumbrance is reported for the facility with which these pig launchers/receivers are collocated.
[e] To avoid double counting, only those lands extending beyond the permanent or construction ROW are reported.
[f] Note that the AGDC indicated that two MLVs would be required along the Fairbanks Lateral, but has not identified their location. It is assumed that these facilities would encumber approximately 0.1 acre of land. Because the location of these facilities is not known, their overlap with the proposed construction and operational rights-of-way could not be determined. Therefore, acreages associated with the two MLVs are not included in the above table.
[g] Source: AES 2012. Acreage estimates include roadway coverage provided by AGDC and not complete 50-foot ROW.

To increase the volume of natural gas transported through a pipeline, the gas is transported under pressure. The maximum allowable operating pressure (MAOP) of the proposed Project mainline pipeline would be 2,500 pounds per square inch gauge (psig). This would be the first 2500 psig transmission pipeline to operate in a public area within the United States. The MAOP for the Fairbanks Lateral would be 1,400 psig. Flow of natural gas through a pipeline causes friction, which results in a reduction of pressure. Compressors are used to increase the pressure and keep the flow of natural gas moving through the pipeline at an appropriate rate. Further, a gas compressor would be installed at the Cook Inlet NGLEP Facility, as discussed further below, to provide sufficient compression of gas for the ENSTAR Pipeline System.

While U.S. cross-country pipelines currently transport high pressure product such as CO_2 and natural gas pipelines in Canada are routinely designed for and operated at high pressures, this proposed pipeline would be among the highest pressures currently planned for natural gas transmission lines in the U.S. Among other lines being planned for high pressure is the Alaska Pipeline Project.

The proposed Project is planned to operate at 2,500 psig in order to maintain a dense phase fluid in the line. If the pipeline is operated at sufficient pressures, two phases (liquid and vapor) would not form and a single, dense phase fluid would be maintained. Further, if the minimum temperature of the fluid is at all times greater than the critical temperature of the mixture, the dense phase fluid would have the properties of a gas.

The word "fluid" refers to anything that would flow and applies equally well to gas and liquid. Dense phase has a viscosity similar to that of a gas, but a density closer to that of a liquid. Because of its unique properties, dense phase has become attractive for transportation of natural gas. Pipelines have been built to transport natural gas in the dense phase due to its higher density, and this also provides the added benefit of no liquids formation in the pipeline. The proposed Project is designed to transport both natural gas and natural gas liquids (an "enriched" gas composition) in order to maximize market opportunities.

Mainline compressor units are proposed at the GCF and the Cook Inlet NGLEP Facility. The Fairbanks Lateral compressor facilities are proposed at the straddle and off-take facility. Compressor equipment collocated with other aboveground facilities are described further below with the collocated facilities. Up to two additional natural gas-fired compressor stations would be located along the proposed Project mainline. The AGDC is currently evaluating the number of additional required compressor stations, but it is anticipated that one to two additional compressor stations would be required to transport 500 MMscfd. Under the one compressor station scenario, the compression facility would be located at approximately MP 285.6. Compression facilities would be located at MP 225.1 and MP 458.1 (collocated with the straddle and off-take facility at this location) under the two compressor station scenario. The location of these compressor station facilities may change during final engineering, but for the purposes of this document, the analysis includes the locations of the compressor station facilities described in Table 2.1-2 and presented in Figures 2.1-2a and 2.1-2b are analyzed. These facilities would typically contain gas turbine-driven centrifugal compressors that would encumber approximately 1.4 acres (Table 2.1-3). Additional facilities at these compressor stations would include gas and utility piping, a filter separator/scrubber, refrigerant condensers, a helicopter port, communication tower, tank farm, power generators, and various control and compressor buildings. Further, propane-cycle gas-chiller plants would be installed at the compressor station (CS) 1 and CS 2, which would be located north of Minto Flats. CS 3 would not require natural gas cooling equipment.

Module sections of the GCF would be transported via barge to West Dock and trucked on existing roads and assembled on-site. Module delivery by sealift will be made by typical sealift barges in use for North Slope deliveries to West Dock. These barges typically have a deck area of 400 feet by 100 feet, and are 25 feet deep. AGDC sealift estimates are based on maintaining a barge draft of less than 5.5 feet to allow for access to West Dock.

AGDC used module square footage for the sealift estimate of nine barges. It was assumed that each GCF module would weigh less than 4,000 tons. Detailed information on the GCF modules is not available at this time. As discussed on page 43 of AGDC's March 2011 Plan of Development (POD), additional details regarding the size/weight and assembly/construction of the GCF modules will be developed as the proposed Project progresses.

The nine-barge lift will be conducted in one open-water season and would meet the necessary scheduling, regulatory, and safety standards associated with a large-scale barge lift. West Dock infrastructure would not require modification to accommodate the modules. Module design, construction, transport, and assembly details would be developed during a later phase of the proposed Project schedule.

The GCF would be installed at MP 0.0 (Figure 2.1-1a) of the mainline. The approximately 68.7-acre facility would receive natural gas from an existing central natural gas facility and remove carbon dioxide (CO_2), hydrogen sulfide (H_2S) and other impurities. Impurities (CO_2 and H_2S) removed during conditioning would be compressed and returned to the producers for reinjection into the reservoir. The natural gas would be compressed to required delivery pressures, and then NGLs (propane, butane, and pentanes) would be injected to enrich the natural gas. After the natural gas is compressed and enriched, it would then be cooled. The GCF would contain several modular buildings that would house equipment, utilities, workspaces, and personnel. Primary and backup power generation, natural gas compressors, and heating and refrigerant equipment in addition to other ancillary facilities would be located at this facility to drive the natural gas conditioning process.

The straddle and off-take facility would be installed at the proposed Fairbanks Lateral tie-in (MP 458.1; Figure 2.1-3a). This facility would be used to provide utility grade natural gas, primarily through the removal of NGLs, prior to sending natural gas into the Fairbanks Lateral. Extracted NGLs would be injected back into the mainline natural gas. Further, compression facilities for the Fairbanks Lateral would be located within the facility footprint. A metering station and pig launcher and receiver, as described further below, would also be located within the facility. Further, under the mainline two compressor station scenario, mainline compressor facilities (CS 3) could be installed. Due to the location of the straddle and off-take facility, no gas refrigeration would be required prior to natural gas reentering the mainline and Fairbanks Lateral pipeline.

An NGL extraction facility, the Cook Inlet NGLEP Facility, would be located at MP 736.4 (Figure 2.1-4a) and would remove propane, butane, and pentane NGLs. To remove NGLs, the extraction facility would contain an inlet and liquid separators, molecular sieve, and a storage facility. The AGDC anticipates that up to 60 MMscfd day of NGLs would be extracted and sold separately from the natural gas. After processing, the utility-grade natural gas would be compressed and transferred via a metering station, as described further below, to the ENSTAR pipeline system. At this time, the AGDC has identified a reasonably foreseeable option for NGL fractionation and storage following the proposed Project terminus. The related facilities are discussed further in Section 5.20, Cumulative Effects.

Metering and flow control of natural gas between the proposed Project pipeline and interconnects with the central gas facility, ENSTAR pipeline system, and the Fairbanks Lateral would be accomplished via meter and regulation facilities provided at meter stations located at each proposed interconnect. The AGDC proposes a meter station at MP 0.0 (GCF), MP 458.1 (straddle and off-take facility), and MP 736.4 (Cook Inlet NGLEP Facility). Each of the proposed meter stations would be located within the footprint of the larger facility with which they would be collocated.

Pig launcher and/or receiver assemblies would be located at all major aboveground facilities, including the GCF (MP 0.0), straddle and off-take facility (MP 458.1), Cook Inlet NGLEP Facility (MP 736.4), and any additional stand alone mainline compressor stations (CS 1 or CS 2; MP 225.1 or MP 285.6). Further, the AGDC indicated that they would install a pig receiver at the terminus of the Fairbanks Lateral (MP FL 34.4). Additional valves and ancillary facilities that would be identified at a later date could also be installed with the pig receiver in this location. The AGDC has not specified the pig receiver facility dimensions or footprints.

Thirty-seven MLVs would be installed along the proposed mainline and Fairbanks Lateral. MLVs would allow the AGDC to shut down or isolate portions of the pipeline, if necessary, and to allow controlled venting during non-routine system blowdowns (see Section 5.19, Reliability and Safety). The MLVs would be installed in areas accessible to operating personnel and at intervals of no greater than 20 miles as specified in U.S. Department of Transportation (USDOT) safety standards for natural gas pipelines (49 CFR Part 192). Each MLV assembly would consist of a below-ground valve with valve operators and bypass extending aboveground. Line break detection systems capable of closing the valve upon sensing a significant drop in pressure potentially indicative of a pipeline rupture would be installed at each MLV site.

Blowdown systems at each MLV as well as the GCF, compressor stations, straddle and off-take facility, and the Cook Inlet NGLEP would be designed to initiate a blowdown whereby in the event the pipeline becomes overpressurized, the pipeline is rapidly depressurized through the automatic opening of blowdown valves and any released gases are dispersed to the atmosphere. Blowdown vents would be located adjacent to valves and in compressor stations. AGDC would develop procedures for controlled releases so that they do not increase operational risk or impacts to the environment, including addressing the potential of liquid spills. Flares would be included with the emergency blowdown systems at the GCF, compressor stations, straddle and off-take facility, and Cook Inlet NGL extraction facility. These flares would be designed for ignition in the event of a facility upset or other condition requiring venting of gas. Following is a summary of the characteristics of the flares based on the current design:

- Gas Conditioning Facility: For each conditioning train, there would be one flare sized for worst-case gas and liquid flow (full plant blowdown) with a capacity of 535 MMscfd. The flare would require an 850-foot offset from other equipment due to radiant heat issues.
- Compressor Station: The flare would be sized for 500 MMscfd with a required offset of 865 feet from other equipment.

- Straddle and Off-Take Facility: The flare would be sized for 71.8 MMscfd with a required offset of 350 feet from other equipment.
- Cook Inlet NGLEP: The flare would be sized for a feed rate of 402,000 pounds per hour, with a required offset of 870 feet from other equipment.

Emergency backup diesel generators are currently specified to provide electrical power in the event of a shutdown that stops gas flow. AGDC has completed preliminary sizing of the backup generators to meet the power requirements of critical life-support and facility-support equipment; however, this sizing is subject to change as the design progresses. Currently, the North Slope Facilities would require two 3.1 Megawatt (MW) generators. Each compressor station would require one generator capable of providing a maximum of 0.1 MW. The Fairbanks Straddle and Off-take Facility would require a generator providing a minimum of 0.1 MW. The Cook Inlet NGLEP would require 0.15 MW of emergency power. AGDC expects to store diesel for emergency generators in on-site tank farms. Each diesel tank is expected to have a storage capacity less than 10,000 gallons. AGDC would meet all ADEC requirements in 18 AAC 75 for spill prevention and contingency planning and would have EPA-required Spill Prevention and Control and Countermeasure (SPCC) Plans for each storage facility with a capacity to store in excess of 1,320 gallons of fuel.

Security fencing would surround the aboveground piping and valves at each mainline valve site. The consequences of an accidental spill of NGLs as a result of a pipeline rupture could include fire and/or explosion of NGL vapors. Potential spill impacts would likely be short-term and low magnitude due to the volatility of NGL components. However, a small portion of the NGLs may not easily vaporize, particularly during the winter, and may remain to potentially migrate through the soils and enter the groundwater if spill cleanup procedures were not implemented.

2.1.3 Land Requirements

The land requirements of the proposed Project are summarized in Table 2.1-3. This summary identifies the temporary construction work areas and operational land requirements of the proposed pipeline and aboveground facilities. Temporary land requirements for the proposed Project during construction would total 11,943.7 acres, including the proposed pipeline construction ROW and TEWSs; construction areas for aboveground facilities; pipe storage, contractor, and rail yards; construction camps; and temporary access roads. Operational land requirements include the permanent pipeline ROW, permanent access roads, and above ground facilities sites.

Approximately 4,148.7 acres would be retained as permanent easements associated with operation of the proposed pipeline, aboveground facilities, and permanent access roads. The approximately 7,795 acres in the temporary construction ROW, TEWSs, construction camps, and storage yards that would not be retained as part of the permanent easement would be returned to pre-construction uses. During operation of the proposed Project, land within the boundaries of the aboveground facilities would be converted to developed land. Vegetation within the permanent easement would be maintained in a non-forested vegetative cover. The land requirements of the proposed Project facilities are discussed below and additional information is provided in Section 5.9, Land Use).

2.1.3.1 Pipeline Right-of-Way

The proposed Project would include approximately 6 miles of aboveground pipeline installed on steel vertical support members (VSMs) located in the Prudhoe Bay operational area. Except for at specific aerial crossing locations, such as at some bridge crossings and at fault crossings, the remaining portions of the proposed pipeline would be installed underground. As proposed by the AGDC, the construction ROW width along underground and aboveground portions of the proposed pipeline would be 100 feet for the proposed mainline. A 100-foot-wide construction ROW has also been proposed along the Fairbanks Lateral. Open-cut trenching techniques would primarily be used to install the pipeline underground (see Section 2.2.2). The 100-foot-wide construction ROW for normal open-cut conditions would include 10 feet on the construction side for temporary storage of topsoil, where required. This 10-foot-wide topsoil storage area would be used only in areas where topsoil stripping would be required. The AGDC has indicated that the identification of topsoil stripping locations would be required but would not be available until final engineering; therefore, this additional land requirement has been assumed to be required for the entire proposed Project length. Figure 2.1-10 depicts a cross-section of the typical proposed construction ROW.

Temporary land requirements include the construction ROW that would be utilized for a relatively short duration during construction. For the purposes of this analysis, the 100-foot-wide construction ROW with a 10-foot offset from the centerline was used (Figure 2.1-7). This would result in dividing the ROW to allow 30 to 40 feet for the spoil-side and 60 feet for the working side of the ROW. In some areas, the proposed construction ROW widths would be expanded to account for site-specific construction requirements, such as ensuring safe working conditions in areas of rugged terrain (see Section 2.2.3) and/or areas requiring rock ditching, gravel or ice workpads, or snow storage. Similarly, the construction ROW would be reduced, or ‘necked down’, in some areas to minimize impacts to sensitive resources, such as residences or high-value wetlands. These locations would be determined during permitting and final engineering. This land is intended to provide adequate space to facilitate safe movement of materials, equipment, and personnel during construction. Occupation of real estate included in the construction ROW would generally be limited to periods of major construction and initial pipeline startup activities.

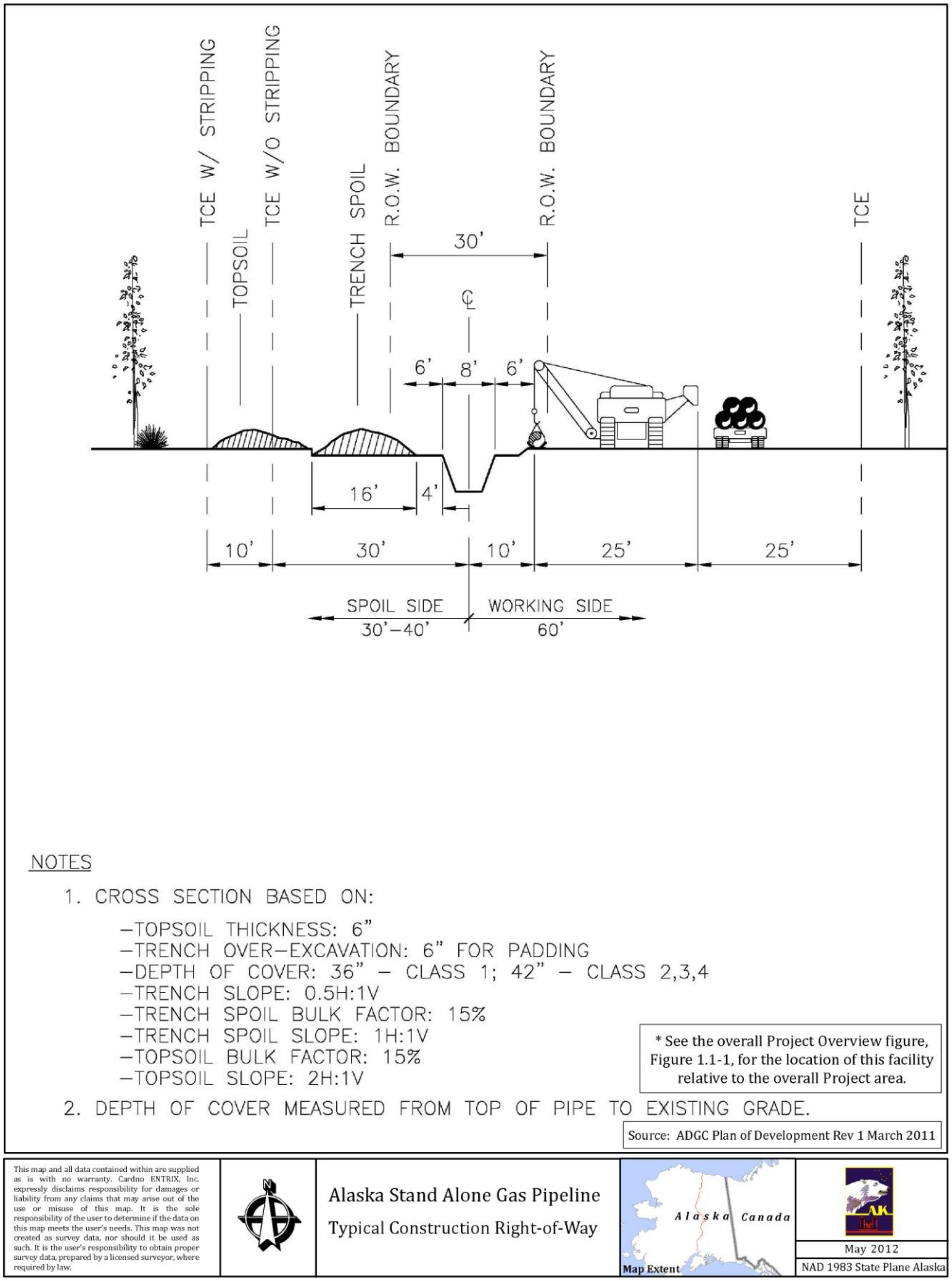


FIGURE 2.1-7 Typical Construction Right-of-Way

Permanent land requirements include the pipeline operating ROW. Non-possessory, non-exclusive land use as authorized by the U.S. Bureau of Land Management (BLM) would be maintained by the pipeline owner and/or operator throughout the operational life of the pipeline facility. BLM requirements stipulate a ROW of 50 feet plus the width of the pipe on federal lands. Therefore, following construction, the AGDC would retain a 52-foot-wide and 51-foot-wide permanent ROW along portions of the mainline and Fairbanks Lateral, respectively that would cross federal lands. A 30-foot-wide permanent ROW would be maintained for the mainline and Fairbanks Lateral for all other non-federal lands. The AGDC has indicated that a larger permanent ROW may be maintained in some locations. These areas have not been identified; therefore, a 30-, 51-, or 52-foot-wide permanent ROW width was used to calculate potential Project-related impacts. The permanent ROW would be within the construction ROW and centered on the pipeline for operation of both the mainline pipeline and Fairbanks Lateral.

2.1.3.2 Aboveground Facilities

The land requirements for the proposed aboveground facilities would total approximately 79.4 acres during construction and 81 acres during operation (Table 2.1-3). The proposed aboveground facilities include up to 2 new compressor stations, 3 meter stations, 37 MLVs, and 5 pig launcher and/or pig receiver facilities. Furthermore, the AGDC proposes to construct the GCF near MP 0.0, a straddle and off-take facility at MP 458.0, and the Cook Inlet NGLEP Facility at MP 736.4.

As shown in Tables 2.1-2 and 2.1-3, multiple aboveground facilities would be collocated within the same fenced proposed facility footprint. Thus, construction and operation of these facilities would not result in additional land requirements beyond that noted for those aboveground facilities. The remaining MLV sites would typically be located on a 0.1-acre parcel largely within the limits of the construction or permanent pipeline ROW.

2.1.3.3 Extra Work Areas Outside of Right-of-Way

Temporary Extra Workspaces

Beyond those lands within the construction ROW, additional construction areas, or TEWS, would be required for construction at road crossings, railroad crossings, crossings of existing pipelines and utilities, stringing truck turnaround areas, wetland crossings, points of inflection (PIs), and waterbody crossings. These TEWS would be located adjacent to the construction ROW and could be used for such things as spoil storage, staging, equipment movement, material stockpiles, and pull string assembly associated with Horizontal Directional Drilling (HDD) installation. A typical example of TEWS in relationship to the pipeline construction ROW is depicted in Figure 2.1-8. Where feasible, TEWS would be constructed outside of saturated/soft wetlands that cannot support equipment.

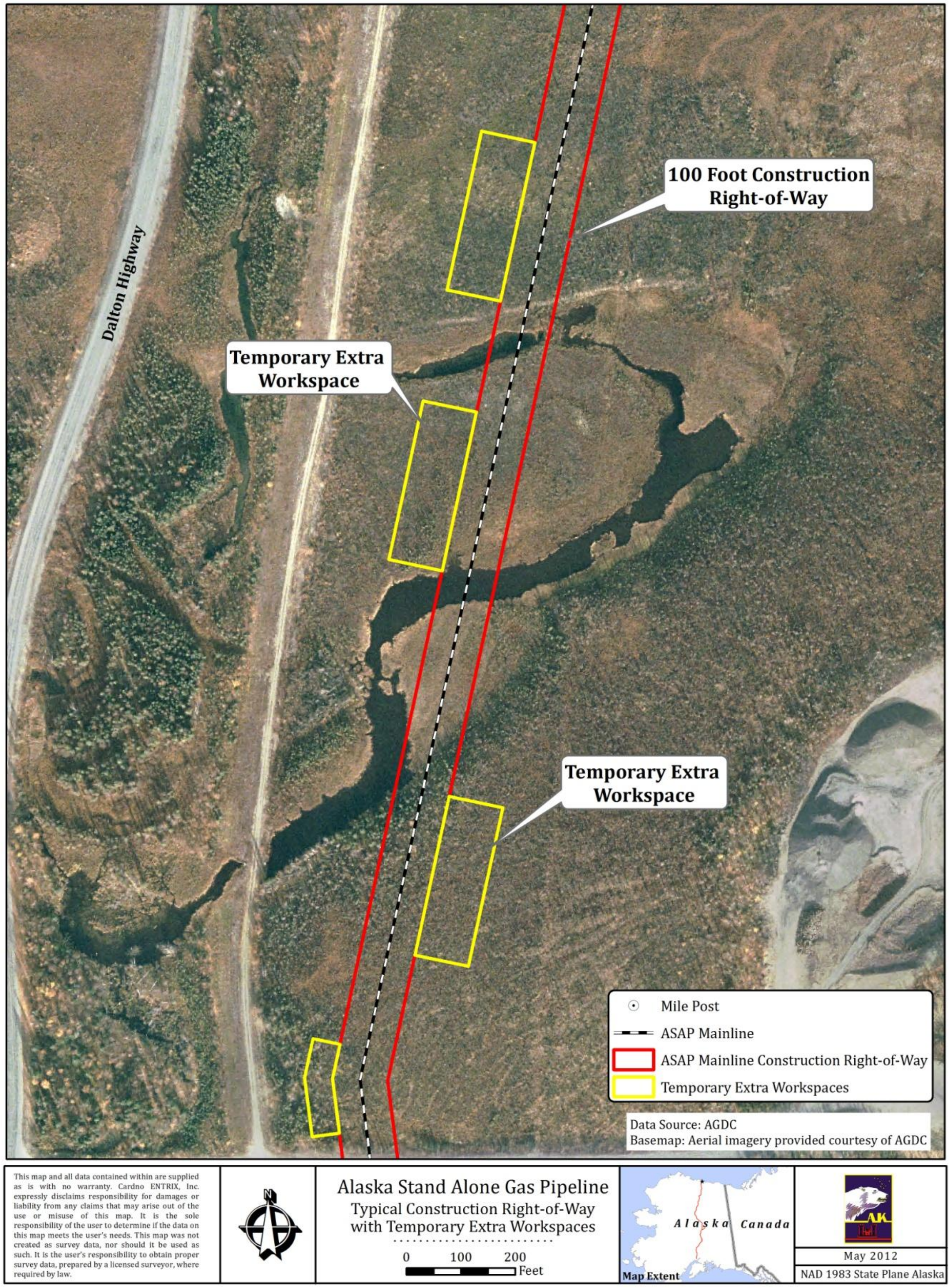


FIGURE 2.1-8 Typical Construction Right-of-Way with Temporary Extra Workspaces

The size of the TEWS would vary depending on site-specific conditions and the proposed use of the TEWS. The TEWS would range in size from less than one half acre to 9 acres, most would be occupy less than 1 acre. A total of 1902 TEWS are proposed (Table 2.1-4). The total area occupied by all proposed TEWS would be approximately 982 acres.

TABLE 2.1-4 Total Number of Temporary Extra Work Spaces (TEWS) by Size

Acres	TEW Gas Conditioning Facility Mile 0 to Mile 540	TEW Mile 540 to Mile 555	TEW Mile 555 to Cook Inlet NGLEP Facility	Grand Total
0 - 0.5	282	2	355	**639**
0.50 - 1.0	880	28	278	**1186**
1.0 - 1.5	54	1	9	**64**
1.5 - 2.0	6	0	0	**6**
2.5 - 3.0	1	0	1	**2**
5.0 - 5.5	1	0	0	**1**
5.5 - 6.0	1	0	1	**2**
8.5 - 9.0	1	1	0	**2**
Grand Total	**1226**	**32**	**644**	**1902**

Along some sections of the proposed Project route (for example, at some major waterbodies, special use areas, roads, and/or railway crossings), pipeline installation would be accomplished via HDD or horizontal bores. HDD requires an entry and exit box, typically 200 feet by 300 feet, for the entry box and approximately 100 feet by 200 feet for the exit box, placed on either side of the feature to be crossed. Some or all of the HDD entry and exit workspaces may be contained within the overall construction ROW. It is estimated that the TEWS associated with the HDD crossings of the Yukon, Nenana, and Tanana Rivers would require approximately 2 acres each for a total land use of 6 acres. The pipe string for the crossings would be laid out within the existing Temporary Construction Easement (TCE) and would not require any additional work space. Horizontal bores also require two pits, typically 100 feet by 250 feet, a majority of which would typically be contained within the construction ROW, on either side of the road or railroad to be crossed. These TEWS would be set back at least 50 feet from all waterbodies and wetlands.

Construction Camps, Pipe Storage Yards, Air Facilities, Rail Yards, and Ports

The location of the proposed construction camps, pipe storage yards, air facilities, rail yards, and ports are depicted in Figure 2.1-9 and the land requirements for these facilities are described further in Section 5.9, Land Use. The Port of Seward (POS) would be the primary port of entry for pipe and equipment for proposed Project construction. Pipe would be stored at the POS and then transported via the Alaska Railroad Corporation (ARRC) to Fairbanks, where it would be double jointed and coated. Pipe would then be transported to pipe storage and lay down yards via truck or rail. The AGDC has proposed to offload pipe at 13 locations along the ARRC system. The West Dock at Prudhoe Bay would be used to receive materials for the construction of the proposed GCF. The AGDC does not anticipate the need for any modification of existing port or rail infrastructure in connection with the proposed Project.

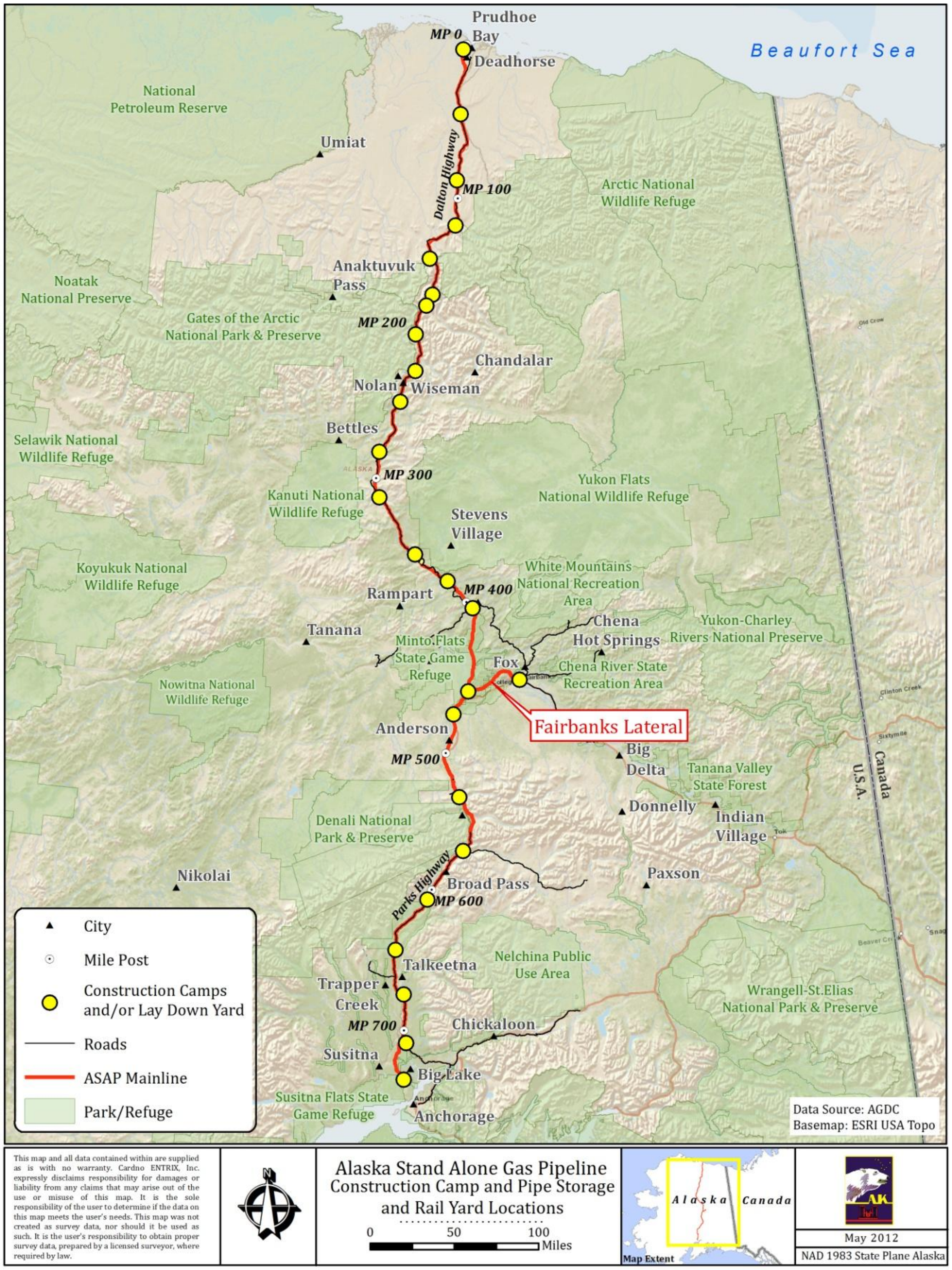


FIGURE 2.1-9 Construction Camp and Pipe Storage and Rail Yard Location Map

The AGDC has proposed the use of 26 off-site pipe storage and lay down yards, including 14 that would be located with stationary construction camps. Further, 14 existing air strips or airports would be used to transport equipment and materials and workers to the proposed Project area. Several of these air facilities would be located at the stationary construction camps or pipe storage and lay down yards. The AGDC anticipates that there could be a need to upgrade existing airports and airstrips by carrying out improvements to runways, runway lights, and communication and navigation aids.

Mobile and stationary construction camps would be constructed in locations along the proposed mainline pipeline where construction and facility crews would require temporary housing during proposed Project construction. Typically, these camps would only be located north of approximately MP 708.0 along the mainline. Mobile construction camps would typically require a footprint of 8.5 to 10 acres and exist for a short duration during activities that would support the preparation of the ROW for construction activities. Where possible, all mobile construction camps would be located within previously cleared and disturbed areas. The AGDC would obtain all permits required to utilize the previously cleared and disturbed areas. A Fire Response and Prevention Plan will be developed for each camp in consultation with the Alaska Department of Public Safety. The use of mobile camps would be primarily limited to the construction preparation phase prior to the establishment of stationary construction camps.

Stationary construction camps would be used for proposed Project personnel, including construction workers, management, agency staff, and support service personnel. Further, stationary construction camps would be used for fuel and equipment storage and as laydown yards. The AGDC has proposed the use of 15 stationary camps that would each house between approximately 250 and 500 workers. These camps would range in size from 8.5 to 10 acres. Further, approximately 250 workers would be housed in existing facilities at Prudhoe Bay.

All of these facilities would be located in previously cleared and disturbed areas and are accessible by the use of existing roads. The stationary construction camps and/or pipe storage and lay down yards would primarily be located in previously disturbed areas that were used for construction of the Trans Alaska Pipeline System (TAPS), ARRC facilities, or for public events.

The AGDC would develop a Comprehensive Waste Management Plan (CWMP) that would include details of how waste would be handled in these areas. Solid waste produced at camps would be reused, recycled, incinerated, or disposed of at ADEC approved disposal sites in accordance with applicable regulations. Domestic wastewater produced from camps would be treated and discharged in accordance with the applicable permits. The AGDC would develop a Spill Prevention and Control Plan (SPCP) that would outline measures that specify where and how hazardous substances, such as fuel, paint, and solvents, would be stored and handled. Further, a Spill Prevention Control and Countermeasure Plan (SPCCP) would be developed for storage facilities where capacity exceeds 1,320 gallons of fuel. Additionally, an Oil Discharge Prevention and Contingency Plan (ODPCP) would be developed if the volume of a refined petroleum product storage facility exceeds 420,000 gallons.

Material Sites

Material sites (i.e., sand and gravel pits) located along the proposed Project would be used to provide gravel for workpads, access roads, pipeline bedding and padding, and the construction of aboveground facilities. The AGDC has estimated that approximately 13.1 million cubic yards of material may be required for proposed Project construction. The AGDC has identified 546 existing material sites using the Alaska Department of Transportation and Public Facilities (DOT&PF) material site information sources, and expects that the use of these sites would be sufficient to meet the proposed Project's needs. AGDC used a subset of 144 open active sites from the list of 546 sites to allocate ASAP material needs. Appendix P provides a listing of all existing material sites identified by AGDC. The AGDC would develop Material Site Mining Plans and Reclamation Plans for each proposed site prior to development. The AGDC would also develop a Storm Water Pollution Prevention Plan (SWPPP) for each proposed site prior to development and maintain best management practices (BMPs) during construction and operation of the material source. The AGDC would obtain all permits and authorizations for material site mining prior to the start of construction.

Additional Support Facilities

The proposed Project offices would be located near a major airport in either Fairbanks or Anchorage and would consist of a Project headquarters, logistic support sites, and construction support offices. This facility would support the proposed Project from the pre-construction phase through the initial operations phase. The proposed Project would require two temporary logistics support sites in Fairbanks and Seward. The Seward logistics support site would be located on or near the ARRC's Seward Track Yard and the site would oversee the reception and distribution of pipe, valves, and other materials. Furthermore, the Fairbanks logistics support site would facilitate both logistics management personnel and quality assurance staff to ensure the quality of pipe coatings and double-jointing procedures.

Three permanent operations and maintenance (O&M) facilities would be developed in support of long term operation. O&M facilities would be located at Prudhoe Bay, Fairbanks, and Wasilla. Each facility would include office facilities, a maintenance garage, and both warm and cold warehouse space. The O&M facility located in Wasilla would also house the pipeline control systems.

Access Roads

The AGDC would use existing public roads and railroads (as described further in Section 5.9, Land Use) to facilitate equipment and material distribution along the proposed Project route. Several temporary and permanent access roads would be required to transport equipment, materials, and workers to the proposed Project areas. Furthermore, access roads would be used to access water sources, material sites, and various aboveground facilities.

The AGDC would construct gravel, ice, and snow roads, in addition to improving existing roads for proposed Project construction and/or operation. As proposed, mainline Project construction would require the temporary use of 28 gravel and ice roads, 11 of which already exist, to access the proposed Project ROW. Furthermore, 107 permanent gravel roads, of which 60 would be new gravel roads, would be required for proposed Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral. Appendix D identifies access roads that have been proposed for proposed Project use. The information in Appendix D includes whether the proposed access road is existing or would be new, whether it would be temporary or permanent, and whether the access road would be constructed using gravel or ice and/or snow.

New gravel access roads would typically be approximately 20- to 24-feet wide at the driving surface, and would be located within a 50-foot-wide ROW. Figure 2.1-10 depicts a typical access road cross-section and Figure 2.1-11 depicts a typical access road plan. Culverts would be installed as necessary to facilitate surface water flow under the access roads. Road shoulders surrounding culverts would be lined with rip-rap (or equivalent per the erosion and sediment control plan).

Project-related use of highways, maintained local roads, and other types of public roadways would typically not require improvements. Per Section 4.1 of *Exhibit A Stipulations* of the Alaska Stand Alone Gas Pipeline/ASAP Right-of-Way Lease, found in Appendix M, prior to the start of construction, AGDC would enter into a comprehensive agreement with DOT&PF for the use of highways and other facilities under the jurisdiction of DOT&PF. Additional information on access roads and the associated land requirements is provided in Section 5.9, Land Use.

No access roads have been permitted to date. All road permitting will be completed following final design of the proposed Project. Many access roads will remain following construction so as to provide access to the pipeline for inspection and maintenance. AGDC will provide ongoing maintenance of all access roads.

2.2 DESIGN AND CONSTRUCTION PROCEDURES

2.2.1 Pipe Design and Wall Thickness

The proposed pipeline facilities would be designed, constructed, operated, and maintained in accordance with the USDOT regulations under 49 CFR Part 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*, and other applicable federal and state regulations. Among other design standards, these regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. AGDC plans to use pipe that complies with American Petroleum Institute (API) X70 standards for the mainline pipe and API X65 standards for the Fairbanks Lateral pipe. Based on current pipeline design variables including pipeline class designations, the proposed Project pipeline wall thickness would typically be between approximately 0.6 (Class 1) and 1.1 inches (Class 4). Specific pipeline and aboveground facility design would be the subject of a supplemental EIS at a later date.

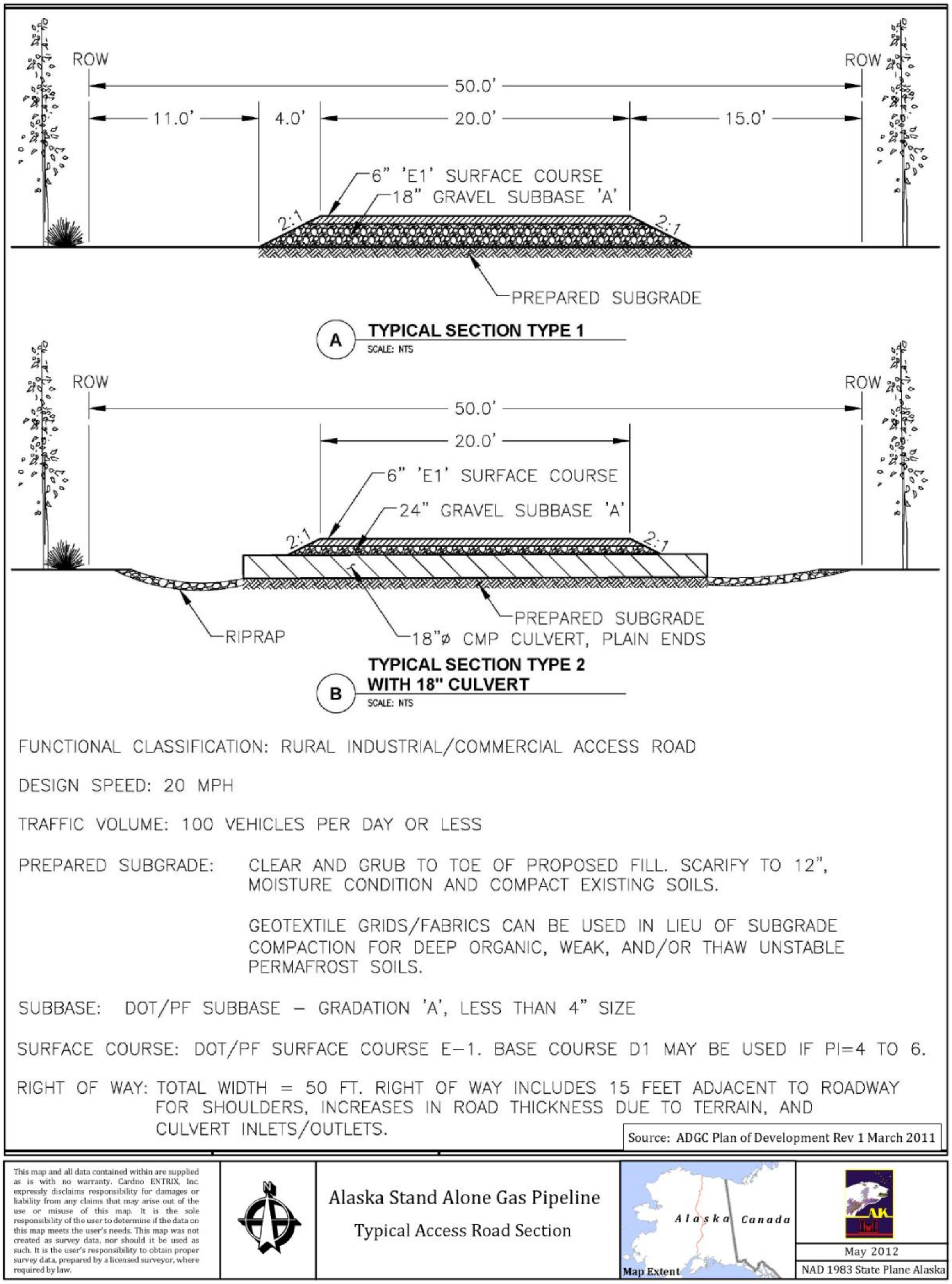


FIGURE 2.1-10 Typical Access Road Section

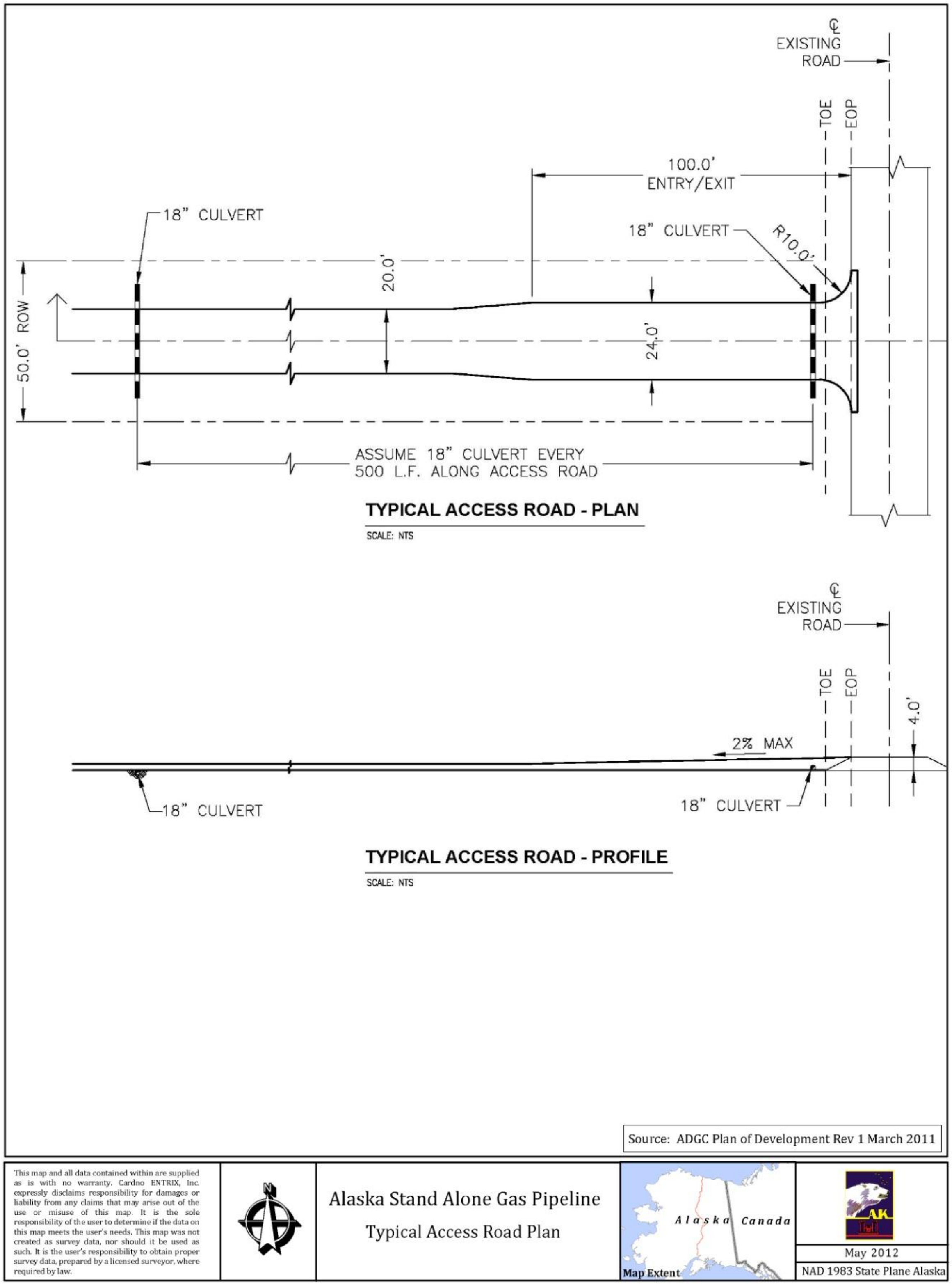


FIGURE 2.1-11 Typical Access Road Plan

2.2.2 Standard Design and Construction Procedures

The majority of the proposed pipeline construction process would be accomplished using conventional open-cut methods, which typically include the steps described below. The proposed methods for accomplishing pipeline installation across waterbodies and wetlands, as well as other specialized construction procedures, are described in Section 2.2.3.

Conventional overland installation of the pipeline is best represented as a moving assembly line with a construction spread (crew and equipment) proceeding along the construction ROW in a continuous operation, as depicted in Figure 2.2-1. According to the AGDC, the length of time a trench would remain open (i.e., trenching to backfill) during construction at a location would typically range from 1 to 3 days. However, construction at any single point along the pipeline, from ROW surveying and clearing to backfill and finish grading, would last about 90 to 120 days (3 to 4 months). Due to weather and terrain features, the AGDC proposes both winter and summer construction.

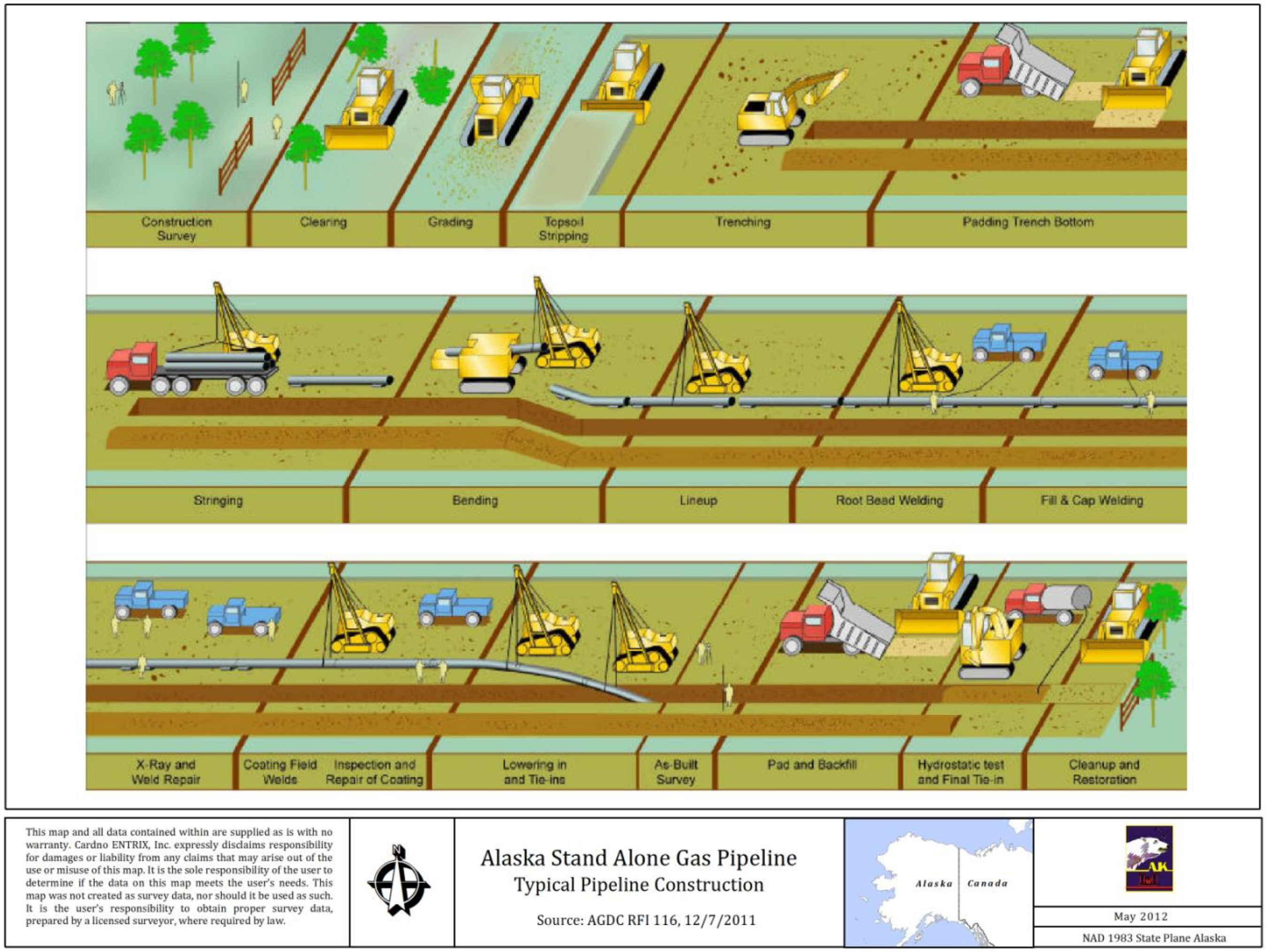
Prior to initiating construction-related activities, the AGDC would secure ROW easements from private landowners and ROW grants from managers of public lands whose properties would be crossed by the pipeline route. All owners, tenants, and lessees of private land, and lessees and managers of public lands along the ROW would be notified in advance of construction activities that could affect their property, business, or operations.

2.2.2.1 Right-of-Way Survey

Prior to construction activities, the pipeline centerline, construction ROW, and additional TEWS would be surveyed and staked. The AGDC would locate, identify, and flag existing underground utilities to prevent accidental damage during pipeline construction. Other sensitive resources, such as trails, easements, and cultural resources also would be marked.

2.2.2.2 Clearing, Grading, and Work Pads

The construction ROW and TEWS areas would be cleared and graded, where necessary, to provide a relatively level surface for trench-excavating equipment and the movement of other construction equipment. Brush, trees, roots, and other obstructions such as large rocks and stumps would be cleared from all construction work areas. The AGDC would complete a merchantable timber survey, and would determine removal methods based on the location of these resources. Stumps would be removed from the proposed construction ROW. Cleared woody debris would be chipped and left in place, burned, provided to local populations for firewood, or otherwise disposed of according to local restrictions, regulatory requirements, and landowner agreements. Work pads would be installed to provide a level work surface during proposed Project construction. Snow/ice, gravel, and/or graded work pads would be installed after clearing and grading.



*Based on site conditions, the order of trenching and stringing/welding may be reversed, and the pipeline would be strung and welded prior to trenching.

FIGURE 2.2-1 Typical Pipeline Construction Sequence

The AGDC would develop an Erosion Sediment Control Plan (ESCP) and a SWPPP prior to the commencement of construction. These plans would outline erosion control BMPs to minimize soil erosion after soil disturbance such as the use of silt fences, bale checks, swales, root waddles, trench and ditch reinforcement with geotextile fabric or rock, gabions and sediment traps. Where present, topsoil would be segregated from subsoil along the proposed Project pipeline. To contain disturbed soils in upland areas and minimize the potential for sediment loss to wetlands and waterbodies, temporary erosion controls would be installed in accordance with the proposed Project's ESCP and SWPPP prior to initial disturbance of soils and would be maintained throughout construction. Erosion and sediment control devices would be installed in accordance with federal, state, or local requirements for the control of stormwater during construction.

2.2.2.3 Trenching

A trench would be excavated using chain excavator and/or track hoes. Excavated materials would normally be stored on the spoil side of the trench, away from construction traffic and pipe assembly areas. Where required, temporary trench breakers (or barriers) would be used to create segments within the open trench to reduce erosion. Trench breakers would typically consist of polyurethane foam, sandbags and/or gravel placed across the ditch. Trench dewatering may also be required along portions of the route.

The pipeline would be buried below the ground surface to a depth that would meet or exceed USDOT standards at 49 CFR 192.327. USDOT minimum depth requirements range from 30 inches of soil or 18 inches of consolidated rock for Class 1 pipeline locations to 36 inches of soil or 24 inches of consolidated rock for Class 2, 3, and 4 locations as well as drainage ditches of public roads and railroad crossings. The actual installation depth of the pipeline would vary and would range from the minimum depth requirements to the depth required for safe crossing of a feature such as a road, highway, railroad, or waterbody. Final design depth would be based on detailed site evaluations. At crossings of utilities or foreign pipelines, the proposed pipeline would be installed at a greater depth, so as to provide for a minimum clearance of 12 inches.

Areas of frozen soil and/or bedrock that might be encountered along the proposed Project route may require blasting. Safety controlled blasting techniques would be used in accordance with a Blasting Control Plan, which would be developed prior to construction for agency review and would follow all applicable requirements for health, safety, and environmental protection, including Alaska Department of Fish and Game (ADF&G) blasting standards. The Blasting Control Plan would address issues including:

- Blast hole loading and placing of explosives;
- Timing delays, wiring, and use of detonation systems;
- Training, and licensing of personnel performing and supervising blasting activities;
- Technical support, quality control, and compliance supervision for blasting activities;

- Blasting in environmentally sensitive areas such as near fish habitat or during sensitive life stages of wildlife (e.g., Dall sheep lambing, bear denning, raptor nesting); and
- Avoidance of impacts related to blasting near existing infrastructure.

2.2.2.4 Pipe Stringing, Bending, and Welding

Sections of double jointed, pre-welded pipe would be delivered in straight sections. The straight sections of pipe would be temporarily placed or “strung” along the excavated pipeline trench, where they would be bent as necessary to follow the natural grade and direction changes of the ROW. Following stringing and bending, the ends of the pipeline would be carefully aligned and girth welded together. The girth welds would be visually inspected and tested to ensure their structural integrity using non-destructive examination methods such as radiography (x-ray), gamma ray, or ultrasound. Those girth welds that do not meet established specifications would be repaired or replaced.

A high-integrity coating, such as fusion-bonded epoxy or a multi-layer pipe coating system would cover and protect the pipeline sections from corrosion. Following welding, the previously uncoated ends of the pipe at all joints would be coated with material compatible with the coating in preparation for installation. The coating on the remainder of the completed pipe section would be inspected for defects, and any damaged areas would be repaired prior to lowering the pipe into the trench. At locations with saturated soils, the pipeline would be coated with concrete, bolt-on river weights, or saddle bags to provide negative buoyancy, if required.

Based on site conditions, the order of proposed Project trenching and stringing and welding may be reversed, and the pipeline would be strung and welded prior to trenching (see Figure 2.2-1).

2.2.2.5 Lowering-In and Backfilling

Prior to lowering the pipeline, the trench would be cleaned of debris and foreign material, and dewatered, as necessary. Trench dewatering would entail pumping accumulated groundwater or rainwater from the trench to stable upland areas. Dewatering would be performed in accordance with applicable federal, state, and local permitting requirements. The bottom of the trench may be padded with course grained materials to protect the pipe coating. The AGDC would adhere to USDOT safety requirements related to the quality of bedding and padding material as well as construction techniques to ensure that the protective coating of the pipeline is not damaged. The pipeline would then be lowered into the trench by appropriately spaced, sideboom tractors working in unison to avoid buckling of the pipe. Trench breakers would be installed at regular intervals where appropriate to prevent subsurface erosion and flow of water between the trench and crossed waterbodies, wetlands, and near-surface groundwater.

After the pipeline is lowered into the trench and adequately protected, previously excavated materials or imported material would be used to backfill the trench. Any excess excavated materials or materials deemed unsuitable for backfill would be evenly spread over the ROW or disposed of in accordance with applicable regulations and landowner requirements. In areas where topsoil has been segregated, the subsoil would be placed into the trench first and topped with the topsoil. Backfilling would occur to approximately 1 foot above existing grade or higher to accommodate future soil settlement. The raised trench backfill is intended to accommodate trench settlement so low areas do not develop after construction and to provide a crowned section, much like a road is crowned so that drainage is directed away from trench. Finally, in low areas or in areas where the existing drainage is concentrated, cross-drainage would be provided to maintain existing drainage patterns to the extent possible. In areas where the proposed pipeline would cross off road trails, the trail crossing would be backfilled with non-frost-susceptible fill, and compacted to the previously existing grade. No spoils, overburden or unused fill would be disposed of within any existing trail corridor. This would be done to avoid abrupt trail surface obstacles and/or grade changes that could result in injuries or death for winter trail users. Continued ground surveillance and corrective erosion control and vegetative maintenance would be employed throughout the construction and operations phases of the proposed Project.

2.2.2.6 Hydrostatic Testing

Once installation and backfilling are completed and before the proposed Project begins operation, the pipeline would be hydrostatically pressure tested in accordance with USDOT safety standards (49 CFR Part 192) to verify its integrity and to ensure its ability to withstand the MAOP. Hydrostatic testing consists of installing a hydrostatic test cap and manifold, filling the pipeline with water, warm water, or a water-methanol solution, depending on the ground temperature. Fluid used for hydrostatic testing would be freeze-protected as necessary in the winter. The pipeline would be pressurized to exceed its MAOP, and the pipeline would maintain that test pressure for an amount of time in accordance with the USDOT safety standards. Ultimately, the entire pipeline would be tested; typically, extended segments of pipeline would be tested individually. Any leaks detected during the test would be repaired, and that segment of pipeline would be re-tested.

Water used for hydrostatic testing would be obtained from designated, permitted, surface water sources. The AGDC proposes to discharge hydrostatic test water directly to upland areas or test water would be diverted to settling basins, as necessary, and then discharged to upland areas to comply with discharge permit limitations in accordance with applicable regulations.

2.2.2.7 Cleanup and Restoration

After completion of backfilling the trench, all remaining trash, debris, surplus materials, and temporary structures would be removed from the ROW and disposed of in accordance with applicable federal, state, and local regulations. Snow pads may require additional summer cleanup; cleanup of these areas would be conducted with low-ground pressure vehicles. All disturbed areas would be finish graded and restored as closely as possible to pre-construction contours. Permanent erosion control measures also would be installed during this phase in accordance with AGDC's Stabilization, Rehabilitation, and Restoration Plan.

The AGDC would consult with the BLM and follow ADNR's Plant Materials Center Revegetation Manual for Alaska. The Stabilization, Rehabilitation, and Restoration Plan would stipulate native seed mixes for different geographic areas, seed application methods, and application rates for fertilizers. Additional information on restoration and revegetation procedures in upland and wetland areas is provided in Sections 5.3, Terrestrial Vegetation and 5.4, Wetlands, respectively.

Pipeline markers and/or warning signs that would be resistant to vandalism would be installed along the pipeline centerline at specified intervals to identify the pipeline location. Furthermore, the AGDC would install boulders, berms, and/or fencing, as appropriate, to limit unauthorized access to the permanent ROW.

2.2.3 Other Construction Procedures

2.2.3.1 Aerial Pipeline

The first 6 miles (MP 0 to MP 6) of the proposed Project would be constructed as aboveground pipeline installed on steel VSMs in the Prudhoe Bay operational area. VSMs would be spaced approximately 20 feet apart and would require a minimum of 7 feet of clearance to the lowest obstruction. After ROW preparations, including clearing and grading, are complete, borings for the VSMs would be drilled by a VSM drill rig. The VSM support column would be set in the boring and the annulus space would be backfilled with concrete slurry. After the required time for the support column to set, horizontal pipe support cross beams would be installed. The pipeline sections would be strung and welded, as described in Section 2.2.2, and then placed on the VSM via sidebooms. Tie-ins and testing of the aerial pipeline would be similar to those described in Section 2.2.2. Figure 2.2-2 depicts a typical VSM configuration

Mitigation of potential VSM movement (i.e. heave, jacking, or subsidence) will be addressed both during construction and operation. During construction, the VSM borings will be approximately 20 to 35 feet deep and will be conducted from an ice pad during the winter construction season. Care will be taken to limit the amount of ground disturbance surrounding the VSM boring in order to maintain as much natural, insulating groundcover as possible. During operation, AGDC will employ industry-accepted techniques for addressing VSM movement related to changes in the nature of the permafrost in which the VSM is installed. Alyeska Pipeline has addressed VSM movement in various ways including, adjusting the height of the crossbeam, adding free-standing heat pipes, and using other techniques to insulate the area surrounding the VSM (BLM 2002).

2.2.3.2 Waterbody Crossings

The proposed Project would cross approximately 495 waterways and drainages (see Section 5.2, Water for further detail). The AGDC has proposed to cross 41 waterbodies via trenchless technology such as the HDD method, 4 waterbodies via new or existing bridges, and the remaining waterbodies via either dry open-cut crossing methods (i.e., dam and pump or flume crossings) or via wet open-cut methods. Additional information on the proposed waterbody crossing procedures and potential environmental consequences is presented in Section 5.2, Water. Figure 2.2-3 depicts a typical waterbody crossing.

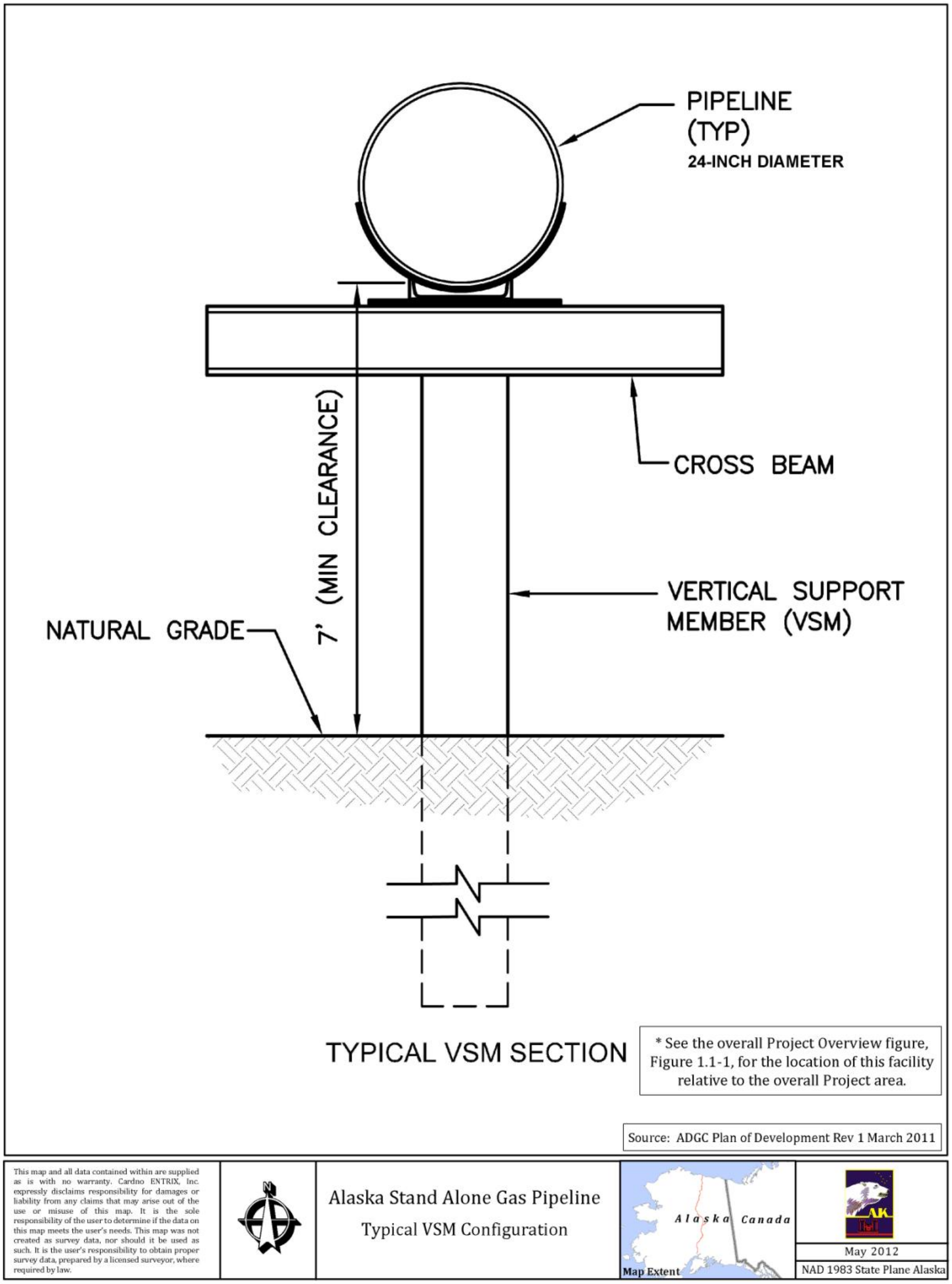


FIGURE 2.2-2 Typical VSM Configuration

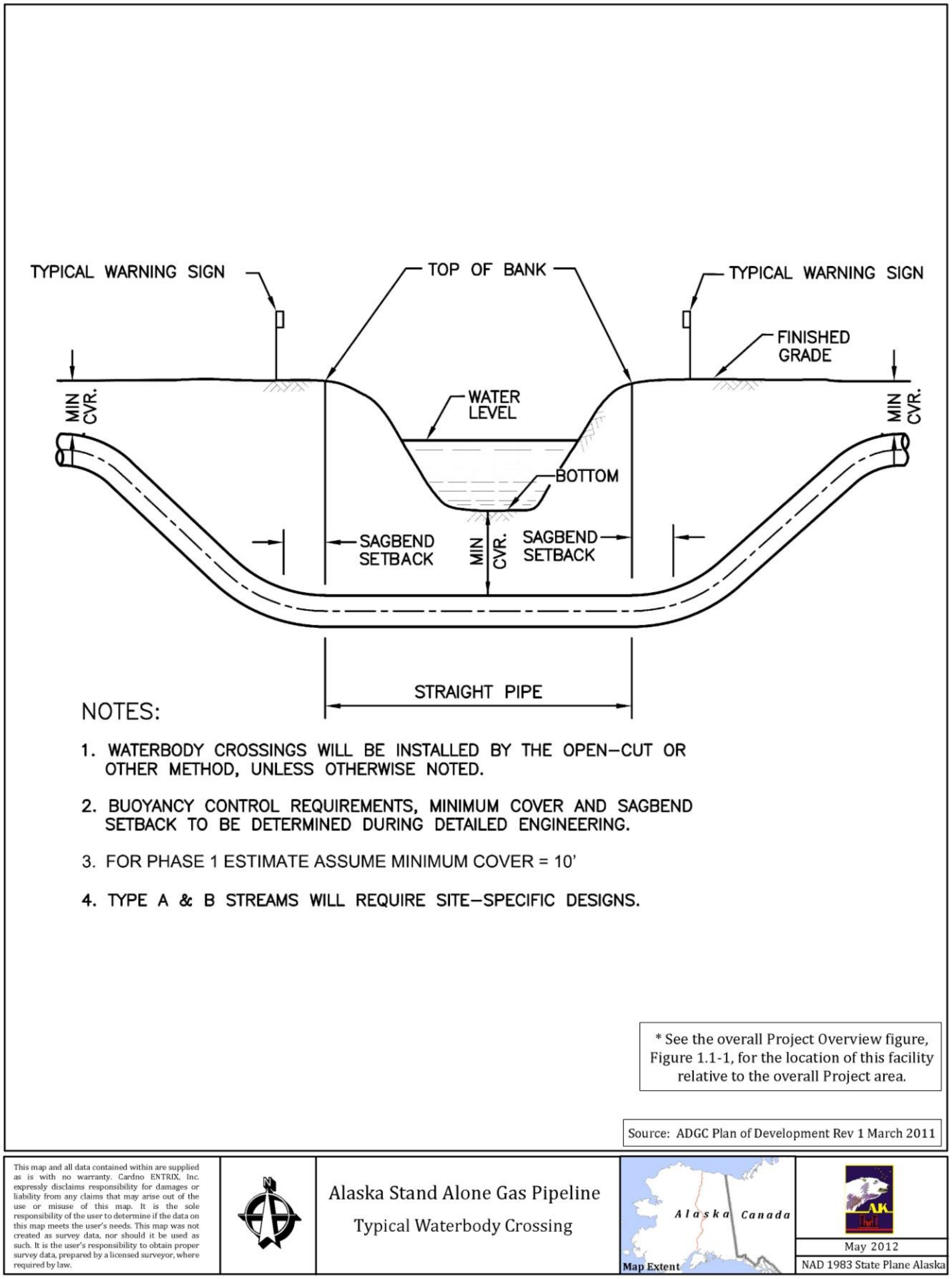


FIGURE 2.2-3 Typical Waterbody Crossing

Wet Open-Cut Waterbody Crossing

In general, a wet open-cut waterbody crossing is accomplished using methods similar to conventional open-cut trenching methods used in upland areas. The open-cut construction method involves excavation of the pipeline trench across the waterbody; installation of a prefabricated segment of pipeline; and backfilling of the trench with native material, with no effort to isolate flow, if any, from construction activities. Some waterbodies could require drilling or blasting to install the proposed Project pipeline. The AGDC would develop a Blasting Plan as described in Section 2.2.2.3 prior to construction to minimize potential blasting impacts to sensitive resources, including aquatic organisms.

Mitigation measures would be implemented to minimize impacts on the aquatic environment during construction. Construction would be scheduled so that the trench would be excavated immediately prior to pipe laying activities. After the design grade is obtained, cut slopes would be stabilized immediately. The waterbody banks would be returned to as near pre-construction contours as possible. Furthermore, to prevent waterbody contamination, the AGDC would keep fuel storage, equipment refueling, and equipment maintenance operations at least 100 feet from waterbodies and wetlands. The AGDC would also develop an ESCP and a SWPPP prior to the commencement of construction, which would outline erosion control best management practices to minimize the potential for upland sediment to enter waterbodies.

The AGDC may also use an open-cut/push-pull crossing method. The open-cut/push pull method is similar to an open-cut waterbody crossing. The push-pull technique involves stringing and welding the pipeline from the streambank, and excavating and backfilling the trench using a backhoe or dragline. Flow within the waterbody is sufficient to float the prefabricated pipeline across the water-filled trench. After the pipeline is floated into place, the backhoe or dragline lowers the pipeline into place.

Dry Waterbody Crossing

The AGDC proposes to use a dry crossing method (flume, dam-and-pump, HDD, or bridge) at waterbodies where overwintering or spawning fish are present, or in locations where wet open-cut crossings are not practical. All work in waters of the U.S. would require authorization by a Section 404 permit to be issued by the USACE.

Flume Crossing

A flume crossing consists of temporarily directing the flow of water through one or more flume pipes placed over the area to be excavated. This procedure would allow trenching across the waterbody to be completed underneath the flume pipes without reducing downstream water flow. Streamflow would be diverted through the flumes by constructing two bulkheads, using sand bags or plastic dams, to direct the streamflow through the flume pipes. Following completion of pipeline installation, backfill of the trench, and restoration of streambanks, the bulkheads and flume pipes would be removed. This crossing method generally minimizes downstream turbidity during trenching by allowing excavation under relatively dry conditions.

This method would only be used in waterbodies with flows that would not exceed the capacity of the flume.

Dam-and-Pump Crossing

Similar to the flume crossing method, the dam-and-pump method involves installing temporary dams upstream and downstream of the proposed waterbody crossing. The temporary dams would typically be constructed using sandbags and plastic sheeting. Following dam installation, appropriately sized pumps would be used to dewater and transport the streamflow around the construction work area and trench. The AGDC would use appropriate fish screening to minimize the incidental entrapment of fish and other aquatic organisms (i.e., entrainment). Trench excavation and pipeline installation would then commence through the dewatered portion of the waterbody channel. Following completion of pipeline installation, backfill of the trench, and restoration of streambanks, the temporary dams would be removed, and flow through the construction work area would be restored. This method is generally only appropriate for those waterbody crossings where pumps can adequately transfer streamflow volumes around the work area and there are no concerns about sensitive species passage.

HDD Crossing

The AGDC proposes to use a trenchless, most likely HDD, crossing method at 41 waterbody crossings. Figure 2.2-4 illustrates a typical HDD installation process. The waterbodies that would be crossed using HDD and other trenchless techniques are described further in Section 5.2, Water.

HDD is a trenchless crossing method that may be used to avoid direct impacts on sensitive resources, such as waterbodies, by directionally drilling beneath them. HDD involves installation of the pipeline beneath the ground surface by pulling the pipeline through a pre-drilled bore hole. HDD installation is typically carried out in three stages: (1) directional drilling of a small-diameter pilot hole; (2) enlarging the pilot hole to a sufficient diameter to accommodate the pipeline; and (3) pulling the prefabricated pipeline, or pull string, into the enlarged bore hole.

Throughout the process of drilling and enlarging the pilot hole, a bentonite clay slurry (drilling mud) would be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and stabilize the open hole. The drilling mud would be a mixture of non-toxic clays and rock particles consisting of about 1 to 5 percent bentonite clay and 0 to 40 percent inert solids. Water required to prepare the slurry of drilling mud would be appropriated from the waterbody being directionally drilled, in accordance with state and local permit stipulations, or transported to storage tanks onsite. Additives may be mixed into the drilling mud to improve drilling conditions, but the AGDC has stated that no synthetic or potentially toxic drilling fluid additives would be used. Drilling mud and slurry would be stored away from the waterbody in tanks, behind earthen berms, or by other methods that would prevent it from flowing off the work area. After the pipeline is installed, the mud would be disposed of in upland areas according to applicable regulations.

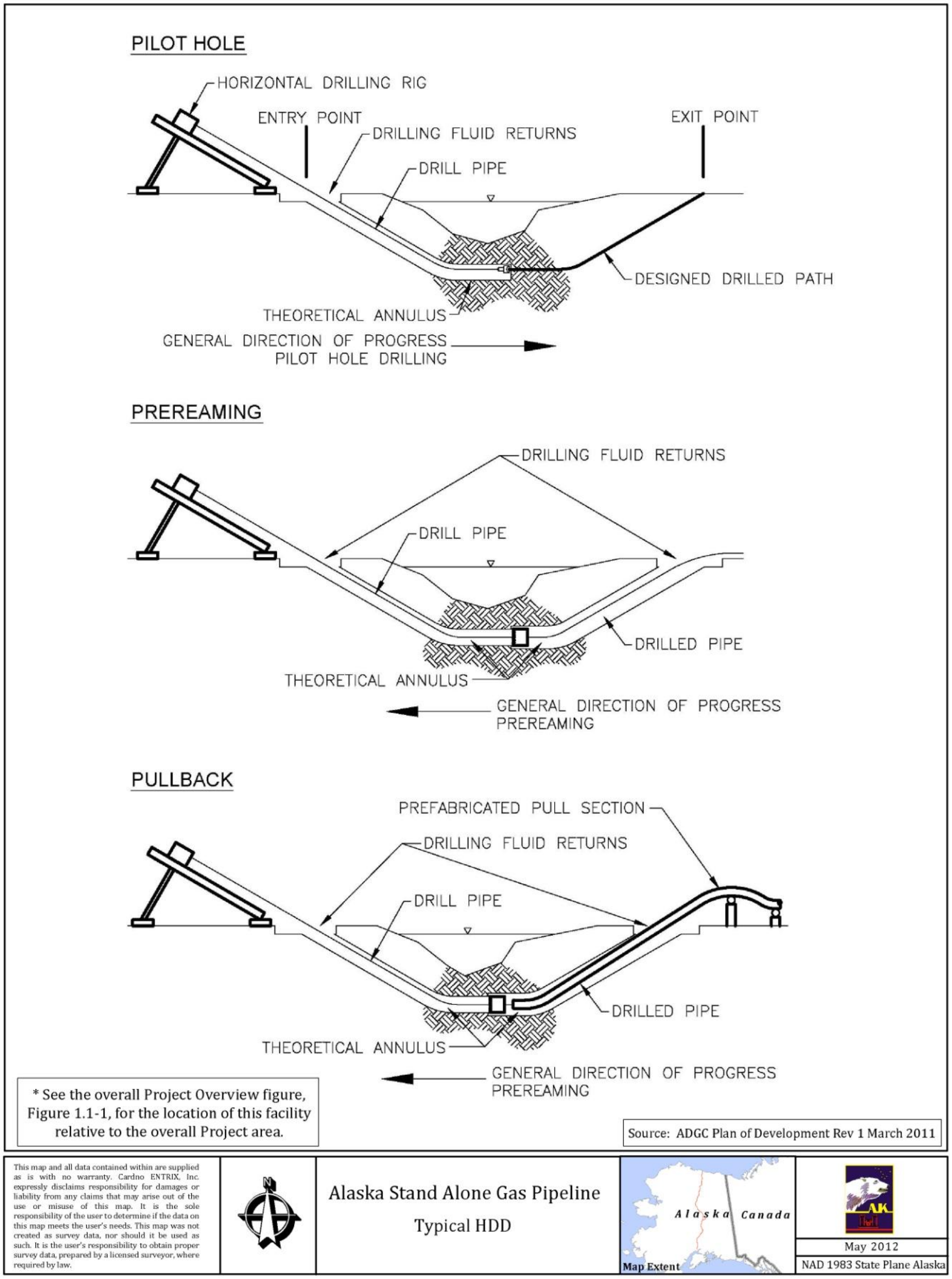


FIGURE 2.2-4 Typical HDD Waterbody Crossing (Option 3)

A successful HDD would result in little or no impact on the waterbody being crossed. HDD is not without risk, however, as inadvertent drilling fluid releases could result if the fluid escapes containment at pits that would be excavated at the HDD entrance and exit points or if a "frac-out" occurs. A frac-out occurs when drilling fluids escape the drill bore hole and are forced through the subsurface substrate to the ground surface. Frac-outs occur most often in highly permeable soils during the entrance and exit phases of the pilot hole drilling, as this is when the greatest pressures are exerted on the bore walls in shallow soils. Drilling fluid pressures in the bore hole and drilling fluid pumping and return flow rates would be monitored to detect the potential occurrence of a frac-out. The AGDC would develop and implement contingency plans for HDD operations with an HDD contractor during final design. This plan would specify drill monitoring, frac-out clean up and contingency procedures. A discussion of the potential impacts of HDD on waterbodies is provided in Section 5.2, Water.

Bridge Crossings

The AGDC has proposed the use of new or existing bridge crossings in four locations along the proposed Project alignment. Bridge crossings would result in the proposed Project pipeline being aerially strung across waterbodies without any surface water disturbance.

The AGDC proposes to attach the pipeline to three existing highway bridges: Chulitna River Bridge, Coal Creek Bridge, and Hurricane River Bridge. In addition, the E.L. Patton Bridge that crosses the Yukon River may also be used, although alternative options are discussed below.

Yukon River Crossing Options

The AGDC originally proposed three options for crossing the Yukon River with construction of a new aerial suspension bridge across the Yukon River the preferred option (the Applicant's Preferred Option). Alternatively, the proposed Project could cross the Yukon River by attaching the pipeline to the existing E.L. Patton Bridge (Option 2) or utilize HDD to cross underneath the Yukon River at the location of the proposed new suspension bridge (Option 3). However, after publication of the DEIS, as part of the federal ROW grant process, AGDC was required to identify a preferred crossing location and method. AGDC then selected construction of a new suspension bridge (the Applicant's Preferred Option) as its preferred crossing location and method. Accordingly, the applicant's proposal is for a suspension bridge crossing of the Yukon River, and the other two options are NEPA alternatives.

If a new Yukon River suspension bridge were constructed (the Applicant's Preferred Option), it is anticipated that no permanent structures, such as footings, would be installed within the Yukon River. Figure 2.2-5 depicts the conceptual Yukon River suspension bridge crossing details.

If the pipeline were attached to the existing E.L. Patton Bridge (Option 2), no surface water disturbance would occur as the proposed pipeline would be installed on a hanger pipe assembly that would be placed underneath the existing bridge deck (Figure 2.2-6). The HDD crossing (Option 3) would require a 1-acre work area at each end of the crossing. The work area would be within the pipeline TCE. The feasibility of an HDD crossing is unknown at this time due to limited soil information. If the soils are similar to those found during the geotechnical exploration of the E.L. Patton Yukon River Bridge 0.6 mile upstream, then the HDD method may not be feasible due to the presence of gravel and fractured bedrock. Further study would also be required to investigate and evaluate the in-situ soils, analyze scour limitations, and to address seismic concerns. Figure 2.2-4 shows a typical HDD waterbody crossing.

Wetland Crossings

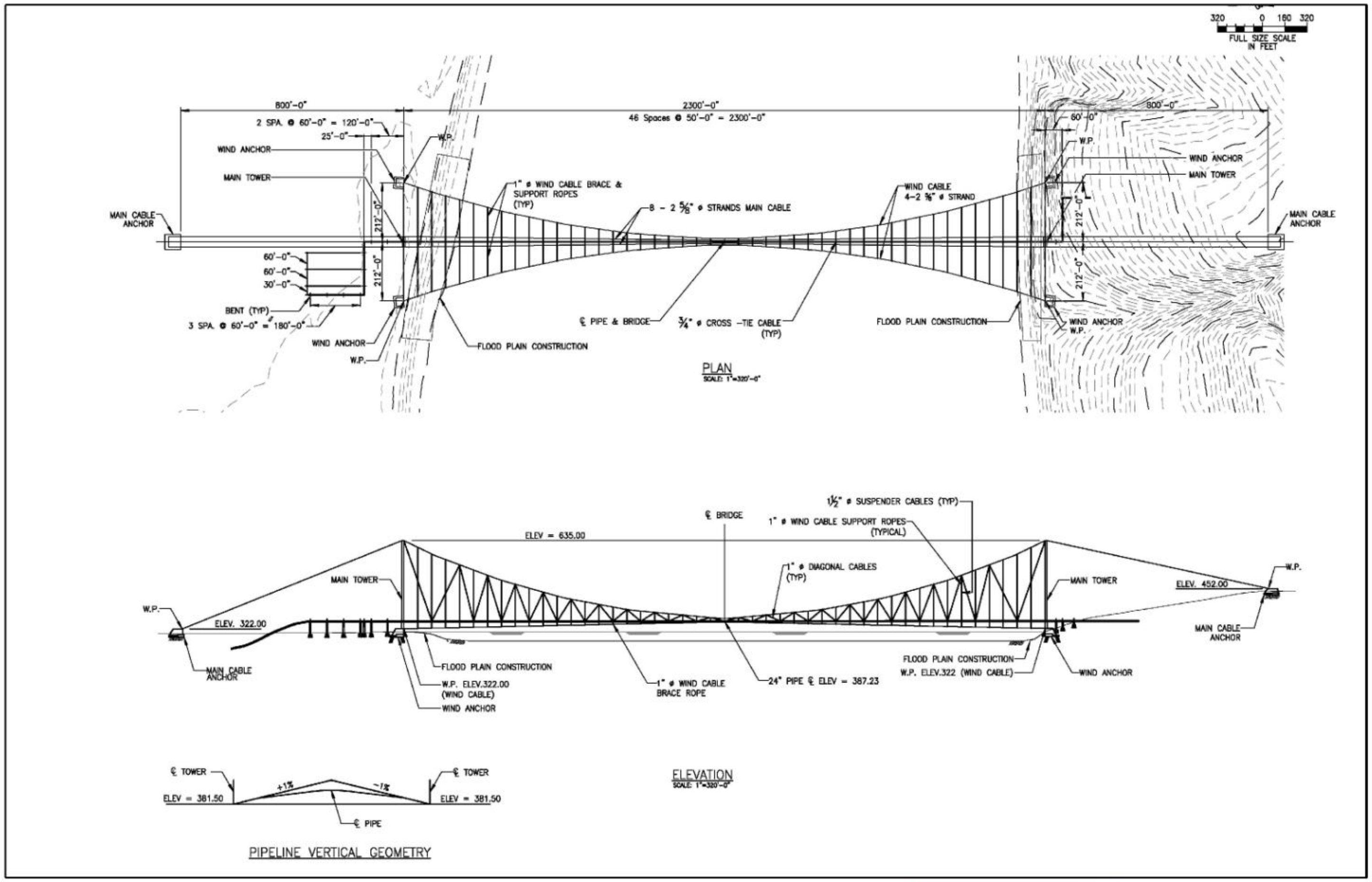
Construction of the proposed Project would be conducted across 593 wetland areas in accordance with applicable permits. The site-specific crossing procedures used to install the pipeline across wetlands would vary depending on the level of soil stability and saturation encountered during construction. Installation of the pipeline across wetlands would be accomplished using one of three crossing methods: open-cut without matting, open-cut with matting or geo-fabric and fill, or open-cut/push-pull. At this time, the AGDC has not proposed to cross any wetlands using the HDD method.

To the maximum extent possible, the AGDC would construct during the winter to minimize potential impacts to wetlands. Grading would primarily be limited to trenching over the trench line to preserve root stock contained in topsoil or the top vegetated mat. During ditch excavation, the top vegetated mat wetland layer would be removed and separated from the subsoil. After pipeline installation and during backfill activities, the vegetative mat would be placed back in the ditch as the last (i.e., top) item with the top of the vegetative mat at the surface of the backfilled ditch. Materials such as timber mats or geo-fabric and fill placed in wetlands during construction would be removed during final cleanup, and the pre-construction contours of the wetland would be restored. Any required permanent erosion control measures would then be installed, and disturbed areas within the wetland would be seeded with native, annual wetland grasses to provide stabilization until natural revegetation occurs.

The wetlands that would be affected by construction of the proposed Project are described further in Section 5.4, Wetlands. Section 5.4 also provides further discussion of the wetland restoration and mitigation procedures that would be implemented by the AGDC.

Open-Cut Wetland Crossing

During crossings of unsaturated wetlands (those wetlands without standing water or saturated soils), construction would primarily be similar to the upland construction procedures described in Section 2.2.2, with the pipeline segment to be installed through the wetland assembled adjacent to the excavated trench. In wetlands with soils too wet (saturated) to support the construction equipment, timber mats or geo-fabric and fill would be used to minimize the impacts of equipment traffic.



Alaska Stand Alone Gas Pipeline
Yukon River Bridge Crossing
Source: AGDC RFI 116, 12/7/2011

Alaska | Canada

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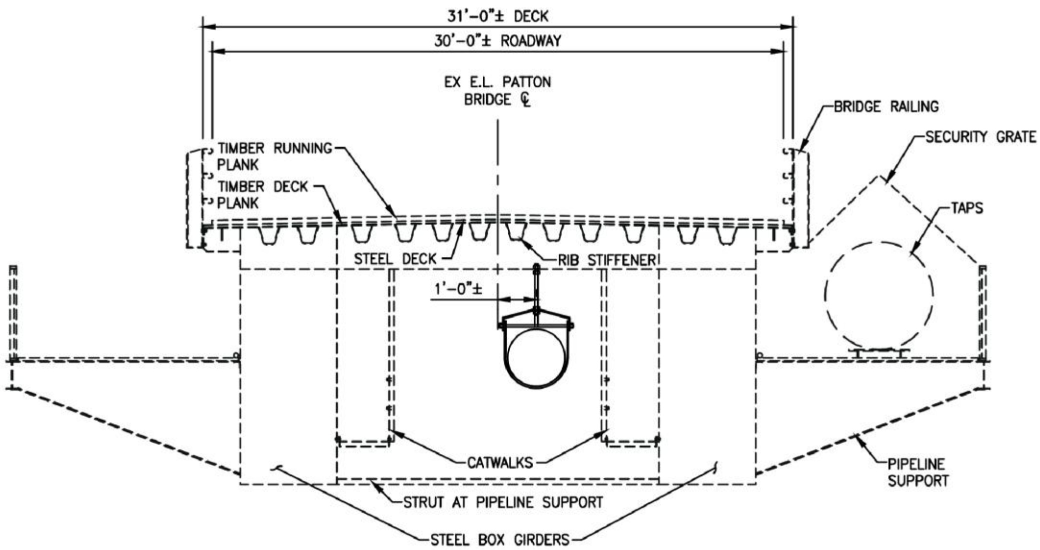
FIGURE 2.2-5 Yukon River New Bridge Crossing (the Applicant's Preferred Option)



E.L. Patton Yukon River Bridge ASAP Placement

* See the overall Project Overview figure, Figure 1.1-1, for the location of this facility relative to the overall Project area.

Source: AGDC RFI 116, 12/7/2011

Alaska Stand Alone Gas Pipeline

Yukon River Existing Bridge Crossing

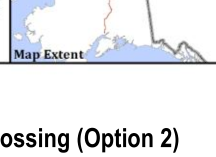


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FIGURE 2.2-6 Yukon River Existing Bridge Crossing (Option 2)

Open-Cut/Push-Pull Crossing

If wetland soils are saturated or inundated at the time of construction, the AGDC may use an open-cut/push-pull wetland crossing method. The open-cut/push-pull technique involves stringing and welding the pipeline from the edge of the wetland, and excavating and backfilling the trench using a backhoe or dragline. All equipment would be positioned on platforms that are constructed on each side of the wetland crossing. The prefabricated pipeline would be installed in the trench within the wetland by equipping it with buoys and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats would be removed and the pipeline would sink into place. In saturated areas or locations with high water tables, the proposed pipeline would be fitted with buoyancy controls.

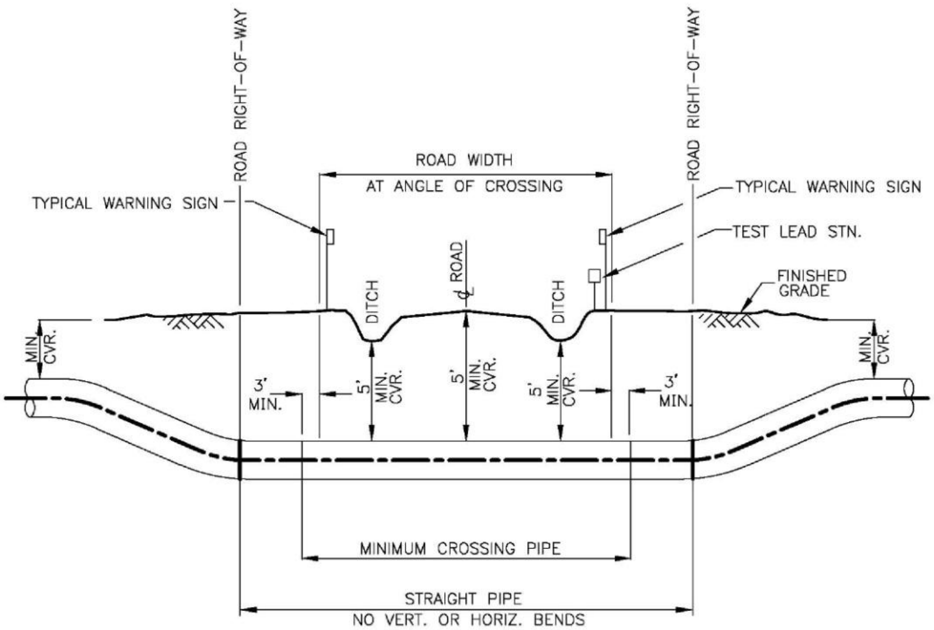
2.2.3.3 Road, Highway, and Railroad Crossings

The proposed pipeline route would cross paved and unpaved roads, highways, and railroads. Construction across these features would be accomplished in accordance with the requirements of all applicable crossing permits and approvals. During construction across roadways, the AGDC would incorporate any safety precautions required by federal, state, and local transportation agencies. Figure 2.2-7 provides a typical arterial road crossing.

Railroads, paved roads, and high-use gravel roads would be crossed via subsurface boring techniques where feasible (horizontal bore or 'slick bore'). Further, the AGDC proposes to cross all TAPS access roads via horizontal bore. Section 5.9, Land Use, provides additional information on the proposed major road crossing locations. Horizontal bores are similar to HDDs in that they avoid direct surface impacts on sensitive resources by installing the pipeline beneath the feature. Horizontal bores are typically much shorter and are used to cross such features as roads or railroads.

Horizontal bores would be accomplished by excavating pits on both sides of the feature to be crossed and boring a horizontal hole equivalent to the diameter of the pipe. The pipeline section would then be pushed through the bore hole. If additional pipeline sections are required, they would be welded to the first section of the pipeline in the bore pit before being pushed through the bore hole.

Where the proposed Project would cross roads via open-cut installation, temporary bypasses or bridges may be installed to facilitate traffic movement. In these areas, heavy walled pipe would be installed to a depth that would withstand vehicle loads. The AGDC would develop and implement a Traffic Control Plan prior to construction. This plan would outline measures that would be implemented to minimize traffic impacts.



NOTES:

1. ARTERIAL ROAD, TYPICALLY A 2 OR 4 LANE PAVED, UNDIVIDED OR DIVIDED HIGHWAY WITH SHOULDERS AND DITCHES. INCLUDES THE DALTON, ELLIOT AND PARKS HIGHWAYS. TYPICAL CROSSING PIPE LENGTH FOR 4 LANE ARTERIAL ROAD = 160' AT 90° CROSSING. TYPICAL CROSSING PIPE LENGTH FOR 2 LANE ARTERIAL ROAD = 80' AT 90° CROSSING.
2. COLLECTOR ROAD TYPICALLY A 2 LANE UNPAVED OR PAVED, UNDIVIDED HIGHWAY WITH SHOULDERS AND DITCHES. INCLUDES STATE HIGHWAY, U.S. HIGHWAY AND BOROUGH ROADS. TYPICAL CROSSING PIPE LENGTH FOR SECONDARY ROAD = 80' AT 90° CROSSING.
3. MEDIAN AND ADDITIONAL 2 LANES FOR ARTERIAL ROAD, NOT SHOWN. ASSUME 12' LANES, 4' SHOULDERS, 20' DITCHES, 50' MEDIAN (ARTERIAL ONLY)
4. CROSSING SHALL BE CONSTRUCTED USING BORE METHOD UNLESS OTHERWISE SPECIFIED.
5. THE CONSTRUCTED PIPELINE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS BETWEEN ROAD RIGHT-OF-WAY BOUNDARYS.
6. FOR TYPICAL EXTRA TEMPORARY WORKSPACE FOR ARTERIAL AND COLLECTOR ROAD CROSSINGS SEE DRAWING SD-ROW-05.

* See the overall Project Overview figure, Figure 1.1-1, for the location of this facility relative to the overall Project area.

Source: ADGC Plan of Development Rev 1 March 2011

Alaska Stand Alone Gas Pipeline

Typical Road Crossing

May 2012

NAD 1983 State Plane Alaska

FIGURE 2.2-7 Typical Road Crossing

2.2.3.4 Rugged Topography

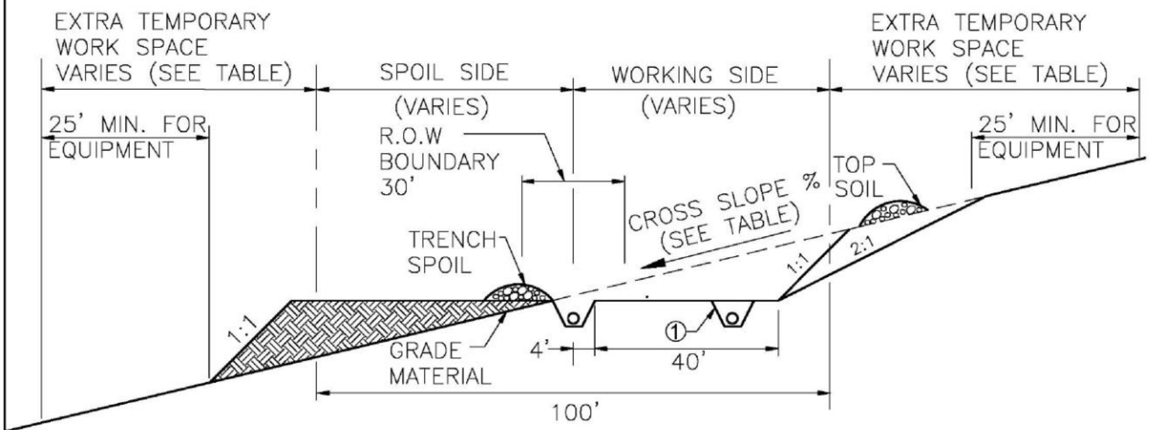
Portions of the proposed Project would traverse areas of side slopes and rolling terrain that could require additional area to create level and safe workspaces. Two-toned or single cut (side hill cuts) construction is a common method of accomplishing pipeline construction in areas of side slopes. The side hill cut construction techniques involve cutting the uphill side of the construction ROW during grading. The material removed from the cut would be used to fill the downhill side of the construction ROW, to provide a safe and level surface from which to operate heavy equipment. The pipeline trench would then be excavated along the newly graded ROW at the appropriate depth beneath the original grade. Figure 2.2-8 provides a typical cross section of the single cut side hill construction technique. The pipeline would be located in undisturbed material to address safety and stabilization issues in a cost effective manner in accordance with PHMSA requirements.

The side hill construction techniques would utilize TEWS areas to accommodate the additional volumes of fill material generated by this technique. Additional information describing proposed TEWS is provided in Section 2.1.3.3. Following pipeline installation and backfill of the trench, excavated material would be placed back in the cut and appropriately compacted to restore the approximate original contours. Additional information on construction through steep slope areas is provided in Section 5.1, Soil and Geology.

2.2.4 Construction Procedures for Aboveground Facilities

The aboveground facilities would be constructed prior to and concurrent with pipeline installation, but construction would be conducted by special fabrication crews generally working separately from the pipeline construction spreads.

Typically, construction of the GCF, straddle and off-take facility, compressor stations, and Cook Inlet NGLEP Facility would involve clearing, grading, and/or compacting the sites to the surveyed elevations, where necessary, and installing a gravel ground cover for placement of modular buildings and support equipment. Site components at aboveground facilities would be modularized to minimize construction, logistics, and commissioning activities. The module sections of the GCF would be transported to the facility site via an anticipated nine barges to West Dock and then transported on existing roads and assembled on site. Section 2.1.2 provides additional details regarding barging. Prefabricated segments of pipe, valves, fittings, and flanges would be shop- or site-welded and assembled at the aboveground facility sites. As necessary, electrical, domestic water and septic, and communications utilities would be installed. Facility piping, both above and below ground, would be installed and hydrostatically tested before being placed in service. Controls and safety devices, such as the emergency shutdown system, relief valves, gas and fire detection facilities, and other protection devices, would also be checked and tested. Upon completion of construction, all disturbed areas associated with the aboveground facilities would be finish-graded and covered with gravel, as appropriate. All roads and parking areas would be graveled. Additionally, the aboveground facilities would be fenced for security and protection.



TYPICAL SECTION
25% GRADE AS DRAWN

CROSS SLOPE %	CUT cu.yd 1:1	CUT cu.yd 2:1	TRENCH SPOIL cu.yd	ETWS Spoil side 1:1	ETWS Spoil side 2:1	ETWS Working side 1:1	ETWS Working side 2:1	TOTAL DISTURBANCE 1:1	TOTAL DISTURBANCE 2:1
25%	14.01	22.00	1.10	45'	55'	45'	75'	190'	230'
24%	13.60	20.00	1.10	40'	55'	45'	75'	185'	230'
22%	12.14	17.00	1.10	40'	50'	45'	70'	185'	220'
20%	10.70	14.30	1.10	40'	50'	40'	60'	180'	210'
18%	9.50	12.10	1.10	40'	50'	40'	60'	180'	210'
16%	8.20	10.10	1.10	35'	45'	40'	55'	175'	200'
14%	7.00	8.35	1.10	35'	40'	40'	50'	175'	190'
12%	5.85	6.70	1.10	35'	40'	40'	50'	175'	190'
10%	4.70	5.35	1.10	30'	35'	35'	40'	165'	175'
8%	3.75	4.05	1.10	30'	35'	35'	40'	165'	175'
6%	2.75	2.95	1.10	30'	30'	30'	35'	160'	165'
4%	1.75	1.85	1.10	30'	30'	30'	35'	160'	165'
2%	0.85	0.88	1.10	30'	30'	30'	30'	160'	160'

* 15% SWELL / BULK NOT INCLUDED

① ALTERNATE PIPE LOCATION. PIPELINE MUST BE LOCATED IN UNDISTURBED MATERIAL.

* See the overall Project Overview figure, Figure 1.1-1, for the location of this facility relative to the overall Project area.

Source: ADGC Plan of Development Rev 1 March 2011

Alaska Stand Alone Gas Pipeline
Side Slope (Single Fill)
Construction Right-of-Way

May 2012
NAD 1983 State Plane Alaska

FIGURE 2.2-8 Typical Side Slope (Single Fill) Construction Right-of-Way

Construction of meter stations, MLVs, and pig launcher/pig receiver facilities would generally be similar to that described for the other aboveground facilities, as most of them would be located within the fenced perimeter of the GCF, compressor stations, straddle and off-take facility, and/or Cook Inlet NGLEP Facility. MLVs and the pig receiver outside of other aboveground facilities would follow a similar construction process, which would entail site clearing and grading, installation and erection of facilities, hydrostatic pressure testing, cleanup and stabilization, and installation of security fencing around the facilities. Typical MLV and pig launcher/receiver configurations are depicted in Figures 2.1-5 and 2.1-6, respectively.

2.2.5 Corrosion Protection and Detection Systems

Cathodic corrosion protection (CP) is generally applied by two methods; either through the use of sacrificial anodes or by an impressed current system powered by a direct current (DC) source. For this proposed Project, both a galvanic magnesium ribbon anode system and impressed current systems primarily located (where necessary) at block valve locations would be used.

Sacrificial anodes are sometimes referred to as a galvanic system because the anodes used are higher (more active) in the galvanic series than the steel they are protecting. With this type of system a metal rod, ingot or ribbon of either high purity zinc or magnesium is placed in the pipeline trench and connected to the pipeline through a test station via an insulated wire. Figure 2.2-9 depicts a typical anode test station.

The impressed current system method of CP operates by impressing a DC through the soil by way of an anode groundbed. There are many configurations for impressed current CP systems. Deep groundbed anodes, for example, are used to protect long sections of pipelines and distributed buried assets such as those found at pump/compressor stations, refineries and terminals. DC Power for the impressed current system can be supplied by either an alternating current (AC) to DC rectifier or a Thermo-Electric-Generator (TEG). AC power could come from existing electrical grids where available. However, due to the remoteness of the pipeline and associated facilities, it is assumed all power would come from gas-fired TEGs near pipeline facilities, such as block valve sites or power generated at a compressor station. Based on this assumption, no power transmission systems outside of the proposed Project footprint would be required for cathodic protection. TEGs, fueled by natural gas, would provide the DC power to the anodes by means of thermocouple heat to electrical energy transfer. Small tubing, tapped to the gas line with pressure reducing regulators, would be required to supply fuel to the TEG at each installation. Figures 2.2-10 and 2.2-11 depict a typical groundbed system.

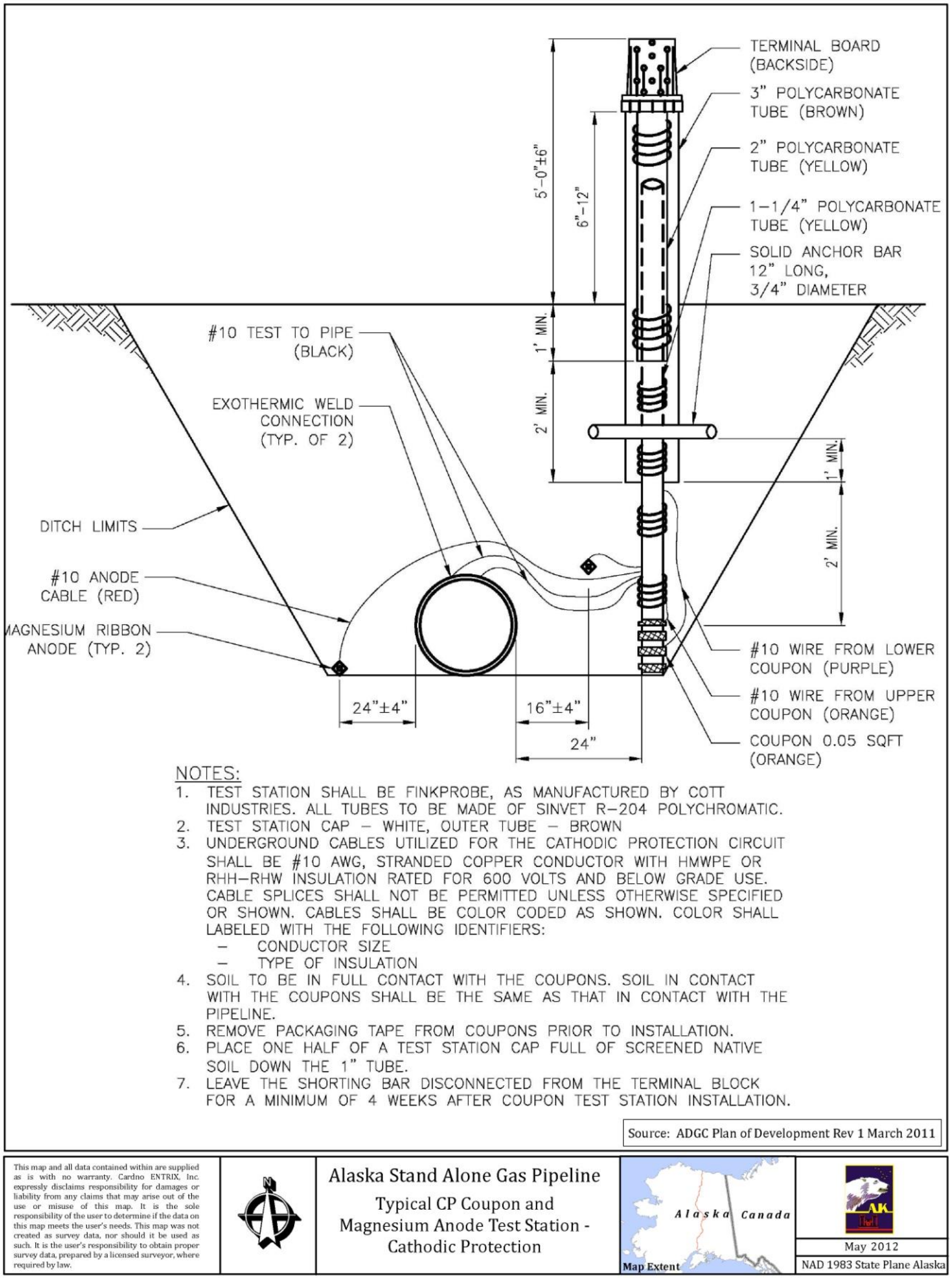


FIGURE 2.2-9 Typical CP Coupon and Magnesium Anode Test Station

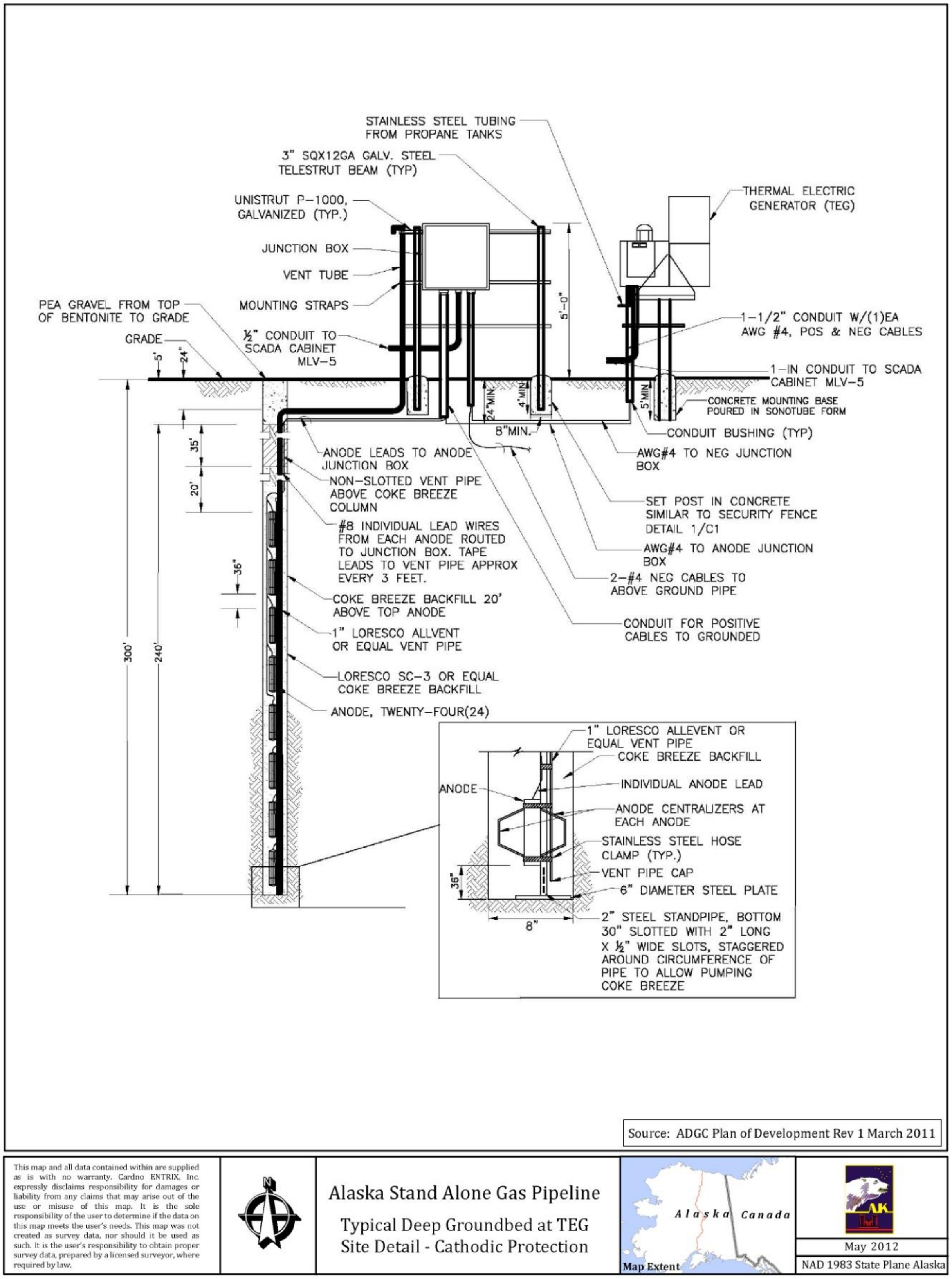


FIGURE 2.2-10 Typical Deep Groundbed at TEG Site Detail

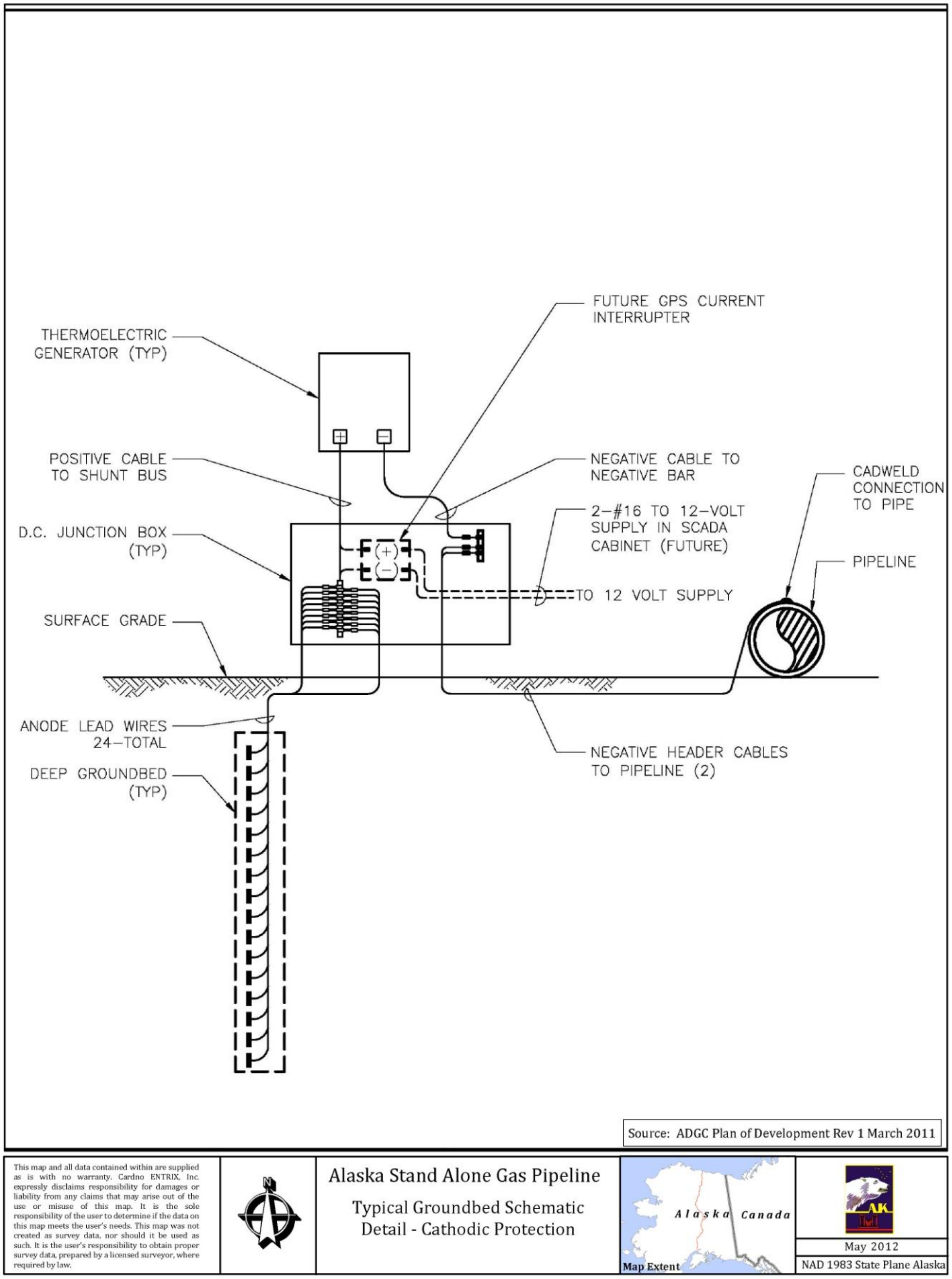


FIGURE 2.2-11 Typical Groundbed Schematic Detail

All cathodic protection system facilities including deep groundbed anodes, where required, would be located within the permanent ROW, at MLVs, at meter stations, or within the compressor stations. As specified by USDOT regulations, aboveground cathodic protection system test stations would be located at less than 1 mile intervals along the proposed route and would be located within the footprint of the pipeline trench excavation. A cathodic protection system test station typically consists of a test wires within a metal conduit, leading to a junction box. The conduit is supported with a painted metal punched post. A testing terminal is located at the top of the pipe that can be accessed by operations personnel to measure the current and determine the potential for corrosion. The cathodic protection system test sites are often located adjacent to pipeline markers. Land impacts for the cathodic protection system test stations have been accounted for within the temporary construction easement, permanent ROW, and permanent workspace requirements for the other proposed Project facilities.

2.2.6 Construction Work Force and Schedule

As currently proposed by the AGDC, construction of the major aboveground facilities would commence in the summer of 2016 and would extend to the summer of 2019. Pipeline construction would be initiated in the winter of 2017 and completed to accommodate an in-service in the fall of 2019. The AGDC primarily proposes winter and summer construction and intends to use five construction spreads to construct the proposed Project. According to the AGDC, the approximate mileposts for each spread are listed in Table 2.2-1.

According to the AGDC, the length of time the trench would remain open (i.e., trenching to backfill) during construction at a location would typically range from one to three days. Construction at any single point along the proposed pipeline, from ROW clearing to backfill and final grading, would typically last about 90 to 120 days (three to four months). Due to weather and trench settling, final grading may occur up to one year after trench backfilling.

The AGDC has proposed 15 worker camps to house workers during proposed Project construction (see Section 2.1.3 and Section 5.9, Land Use). All of these camps would be located at existing construction camps or previously cleared and disturbed areas. Workers would also be housed in local accommodations when available. The AGDC has not provided a housing plan that would address potential increases in local housing demand and the associated increases in traffic in these areas.

The AGDC anticipates that construction of the proposed pipeline at peak construction would require approximately 6,400 workers, comprised of 5,500 on the pipeline and 900 on the facilities (Table 2.2-2; also see Section 5.12, Socioeconomics). It is anticipated that work would continue into the winter of 2019, but at this time employment estimates are not available beyond the fall of 2018. After construction is completed, it is anticipated that the operations and maintenance of the facilities and infrastructure planned for development under the proposed Project would require between 50 to 75 O&M employees, with most workers concentrated at the facilities near Prudhoe Bay, Fairbanks, and Cook Inlet (See Table 5.12-15). No additional permanent O&M workers are anticipated.

TABLE 2.2-1 Construction Spread by Season and Location

Spread	Section	Location	Start (MP)	End (MP)	Length (Miles)	Construction (Season)
1	1A	GCF to PS-1	0	6	6	Winter 1
1	1B-1	PS-1 to Happy Velley	6	88	82	Winter 1
1	1B-2	Happy Valley to Atigun River Valley	88	163	75	Winter 2
1	1C-1	Atigun River Valley to North Atigun Pass	163	173	10	Summer 1
1	1C-2	North Atigun Pass to Chandalar Shelf	173	183	10	Summer 2
Spread 1 Total:					**183**	
2	2A-1	Chandalar Shelf to Coldfoot	183	248	65	Winter 1
2	2A-2	Coldfoot to Prospect River	248	286	38	Winter 2
2	2B	Prospect River to Ray River	286	348	62	Summer 1
2	2C	Ray River to Yukon River	348	360	12	Winter 2
Spread 2 Total:					**177**	
3	3A	Yukon River to Livengood	360	405	45	Summer 1
3	3B-1	Livengood to Little Goldstream	405	468	63	Winter 1
3	3B-2	Little Goldstream to Healy	468	529	61	Winter 2
Spread 3 Total:					**169**	
4	4A-1	Healy to Nenana River	529	535	6	Summer 1
4	4A-2	Nenana River to Lynx Creek	535	541	6	Fall 1 / Winter 2
4	4B	Lynx Creek to Honolulu Creek	541	602	61	Summer 1
4	4C-1	Honolulu Creek to Susitna River	602	673	71	Winter 1
4	4C-2	Susitna River to Beluga South Terminus	673	737	64	Winter 2
Spread 4 Total:					**208**	
Mainline Total:					**737**	
Fairbanks Lateral		Mainline (MP 459) to Fairbanks	0	35	35	Summer 2

Notes:
GCF = Gas Conditioning Facility
MP = milepost
PS = Trans Alaska Pipeline System Pump Station

TABLE 2.2-2 Estimated Workforce Numbers for the Proposed Project

Season	Summer 2016	Fall 2016	Winter 2017	Summer 2017	Fall 2017	Winter 2018	Summer 2018	Fall 2018
Persons for Pipeline	2,500	1,150	3,200	5,500	2,200	3,800	2,200	100
Persons for Facilities	200	400	800	900	600	450	850	250
Total	**2,700**	**1,550**	**4,000**	**6,400**	**2,800**	**4,250**	**3,050**	**350**

TABLE 2.2-3 Construction Timeline for Major Facilities

Activity	Start Date	Completion Date	Calendar Days
GAS CONDITIONING PLANT (GCF)	7/1/2016	6/30/2019	1,095
Fabricate Modules	7/1/2016	6/30/2018	729
Pre-Construction Preparation	4/1/2017	3/31/2018	364
Modular Sea-Lift	7/2/2018	9/30/2018	91
Install & Testing	10/1/2018	6/30/2019	273
STRADDLE and OFF-TAKE FACILITY	7/1/2016	6/30/2019	1,095
Fabricate Skids	7/1/2016	4/1/2018	639
Pre-Construction Preparation	4/1/2017	3/31/2018	364
Construction and Testing	4/1/2018	6/30/2019	456
COMPRESSOR STATIONS	7/1/2016	6/30/2019	1,095
Fabricate Skids	7/1/2016	4/1/2018	639
Pre-Construction Preparation	4/1/2017	3/31/2018	364
Construction and Testing	4/1/2018	6/30/2019	456
COOK INLET NGL EXTRACTION PLANT (NGLEP)	7/1/2016	6/30/2019	1,095
Fabricate Skids	7/1/2016	4/1/2018	639
Pre-Construction Preparation	4/1/2017	3/31/2018	364
Construction and Testing	4/1/2018	6/30/2019	456

Original scheduled furnished Michael Baker Jr., Inc, February 2011 for the POD. Dates have been advanced to represent a change in schedule following discussions with AGDC in March of 2012.

2.2.7 Water Needs and Waste Disposal

During construction and operation of the proposed Project, water would be required for multiple activities such as hydrostatic testing, ice production, dust control, and operations and maintenance activities. The AGDC anticipates that approximately 44.8 million gallons would be required for earthwork, 80.6 million gallons for hydrostatic testing, 66.8 million gallons for access roads, and 782.7 million gallons for work pads. The AGDC is currently conducting studies to ascertain appropriate water sources and would identify those sources at a later date. The AGDC has not specifically identified how wastewater (including domestic wastewater or hydrostatic test water) generated by the proposed Project would be treated, but they have indicated that it would be treated in accordance with applicable regulations and permitting. The AGDC would develop a Comprehensive Waste Management Plan that would include wastewater treatment and discharge measures.

As discussed above, the AGDC would develop a Comprehensive Waste Management Plan that would describe hazardous and non-hazardous waste handling and disposal in detail. Furthermore, the AGDC would develop a Spill Prevention and Control Plan and a Spill Prevention and Control and Countermeasure Plan. These plans would outline hazardous material storage, handling, and disposal methods.

The majority of solid waste will come from construction camps. Table 2.2-4 provides estimated volumes of camp waste expected to be generated during construction.
Other solid waste expected to be generated by the proposed Project could include:

- Any packaging material removed from pipe after it arrives in Fairbanks (this material will remain in Fairbanks).
- Construction dunnage on the right-of-way: Chocks, blocking, and lashing for pipe and components will be recycled/reused.
- Packaging and small containers for materials such as pipe weld coating.
- Volumes for the above miscellaneous wastes are not available at this time, but they will be small in comparison to the camp-generated waste.

TABLE 2.2-4 Estimated Solid Waste Generation for ASAP Construction Camps by Season (Tons)

Camp Locations	Pre-Constr.	Winter 1	Summer 1	Fall 1	Winter 2	Summer 2	Post-Constr.	PROJECT TOTALS (Tons)
Spread 1	585	1,598	165	11	923	165	585	**4,032**
Spread 2	315	473	615	11	923	15	315	**2,667**
Spread 3	225	923	315	11	473	15	225	**2,187**
Spread 4	405	923	915	236	923	15	405	**3,822**
Compressor Stations	0	0	0	0	0	180	0	**180**
TOTALS (Tons)	**1,530**	**3,917**	**2,010**	**269**	**3,242**	**390**	**1,530**	**12,888**

Notes:
A conservative rate of 10 pounds of solid waste per person per day was assumed. (The large volume of wholesale packaging can double the 2010 EPA rate of 4.43 pounds/person/day.)
Pre-construction fly camps include but are not limited to main camp construction, survey, grading, clearing, hauling, and borrow sites operations.
Post-construction fly camps include but are not limited to demobilization of camps and equipment, and first-year right-of-way maintenance.

During operations, the quantity of waste generated is expected to be small, with an estimate of 100 pounds per day based on 2 pounds per day for 50 people (10 in Prudhoe, 10 in Fairbanks, and 30 in Wasilla).

For disposal of solid waste, AGDC would use either landfills or incinerators. Existing permitted landfills would be used, and the operators would decide whether or not to accept this solid waste. Incineration would be used only where the appropriate permits can be obtained, and any air emissions from permitted incinerators would have been accounted for in the permit actions at the approved facilities.

At this time, AGDC does not have enough information to be able to identify what will be landfilled and what will be incinerated, or to identify which specific facilities would be used. AGDC would haul solid waste as far as necessary to reach suitable disposal facilities.

2.3 OPERATION, MAINTENANCE, AND SAFETY CONTROLS

The proposed Project pipeline and aboveground facilities would be designed, constructed, operated, and maintained to meet all safety standards set forth in industry and in the USDOT Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards (49 CFR Part 192). These safety standards are discussed further in Section 5.19, Reliability and Safety.

2.3.1 Normal Operations and Routine Maintenance

The pipeline would be constructed of welded carbon steel that meets or exceeds industry standards and would be covered with a protective coating to minimize rust and corrosion. To protect against damage from external forces, the proposed pipeline would be buried to appropriate depths that would meet or exceed the USDOT standards at 49 CFR 192.327. All welds joining each section of pipe would be visually inspected and tested using non-destructive examination methods such as radiography (x-ray), gamma ray, or ultrasound to ensure the integrity of the welds. Prior to being placed in service, the pipeline would be hydrostatically pressure tested to verify its integrity and to ensure its ability to withstand the maximum designed operating pressure. A cathodic protection system would be installed to protect all underground and submerged pipeline facilities constructed of metallic materials from external, internal, and atmospheric corrosion. These construction methods would help to assure that the proposed Project would operate as designed and to minimize the chances for leaks.

Fire alarm detection or suppression systems will be installed at facilities in accordance with all applicable codes and regulations, in particular, 49 CFR 192.163, Compressor Stations: Design and Construction, which requires that “Electrical equipment and wiring installed in compressor stations must conform to the National Electrical Code, ANSI/NFPA 70, so far as that code is applicable” (subparagraph 2[e]). In addition, 49 CFR 192.171, Compressor Stations: Additional Safety Equipment requires that compressor stations must have adequate fire protection facilities (subparagraph [a]).

Prior to placing the proposed Project in service, the AGDC would develop an O&M Plan in accordance with 49 CFR 192. This plan would provide written schedules and procedures for conducting operations and maintenance activities and it would be updated at least annually.

Pipeline maintenance includes both preventative maintenance to ensure equipment and systems continue working efficiently, and corrective maintenance to fix or replace equipment and systems that are not working. The O&M Plan includes procedures to provide safety during maintenance including procedures for operating, maintaining, and repairing the pipeline in accordance with applicable requirements; controlling corrosion; maintaining construction records, maps, and operating history and making these documents available to the appropriate operating personnel; and maintaining aboveground facilities, including provisions for isolating units or sections of pipe and for purging before returning to service. In general, removal or addition of equipment or pipe for maintenance is expected to occur at major facilities where the pipeline is aboveground. Removal or addition of equipment or pipe could take place at other locations (e.g., MLVs). All procedures for these activities would be detailed in the O&M Plan. Procedures would be developed and carried out in accordance with applicable regulation and would follow BMPs.

Three O&M facilities are planned for the proposed Project, one at the GCF in Prudhoe Bay, one in Fairbanks, and one at the Cook Inlet NGL Facility near Big Lake. Each location would include office facilities, a maintenance garage, and both warm and cold warehouse space. The Big Lake O&M facility would also house the pipeline control systems. Each O&M facility would be accessible via road and would have sufficient parking for staff, visitors, and maintenance vehicles. All major facilities would be accessible via the road system. In addition, a number of roads would provide access to the proposed Project operational ROW. In general, it is expected that limited maintenance would be required on the ROW. A schedule for maintenance would be developed in accordance with all pertinent regulations and would follow BMPs.

Information about O&M personnel requirements and work schedules are based upon early planning stage man-load estimates. Additional information regarding the number of personnel to be employed for O&M would be developed as the proposed Project progressed. Preliminary calculations for O&M estimate that 10 workers would be required in Prudhoe Bay to run and manage the GCF and the Prudhoe Bay O&M Facility; 10 workers in Fairbanks for the Fairbanks O&M facility; and 30 workers for the Cook Inlet NGL Extraction Facility and the Big Lake O&M facility. Off-site housing would be provided for GCF workers, likely at a commercial camp located within Deadhorse. Personnel located in Fairbanks and Big Lake would be responsible for providing their own housing within local communities. The AGDC estimates that up to 25 workers could be employed at both the Straddle and Off-Take facility and the compressor station(s) combined. At this time it is unknown if these facilities are to be manned.

During operations, the AGDC would conduct regular patrols of the pipeline ROW in accordance with the requirements of 49 CFR Part 192. The patrol program would include periodic aerial and vehicle patrols of the pipeline facilities. These patrols would be conducted to survey surface conditions on and adjacent to the pipeline ROW for evidence of leaks, unauthorized excavation activities, erosion and wash-out areas, areas of sparse vegetation, damage to permanent erosion control devices, exposed pipe, and other conditions that might affect the safety or operation of the pipeline. The cathodic protection system also would be inspected periodically to ensure that it is functioning properly. In addition, pigs would regularly be sent through the pipeline to check for corrosion and irregularities in the pipe in accordance with USDOT requirements. The AGDC would keep detailed records of all inspections and supplement the corrosion protection system as necessary to meet the requirements of 49 CFR Part 192.

AGDC would comply with Stipulation 3.5.3 of the State Right-of-Way Lease for the Alaska Stand Alone Gas Pipeline/ASAP, ADL 418997, contained in Appendix M. This stipulation requires "a reliable voice and data communication system and backup that shall provide information to a control center and be fully usable for an incident command system" and states that part of the communication system "shall be a fully functioning and reliable Supervisory Control and Data Acquisition (SCADA) system".

Pipeline markers would be placed and maintained at line-of-sight intervals along the ROW and at roadway crossings, railroad crossings, and other highly visible places to alert those contemplating working in the vicinity of the location of the buried pipeline.

The pipeline operator also would participate in appropriate One-Call system (Alaska Digline). This program provides telephone numbers for excavation contractors to call prior to commencing any excavation activities. The One-Call operator would notify the AGDC of any planned excavation in the vicinity of the pipeline so that the AGDC could flag the location of the pipeline and assign staff to monitor activities, if required.

2.3.2 Abnormal Operations

The O&M Plan would also include written procedures for standard Project operations and maintenance activities. Further, the O&M Plan would describe procedures that would be implemented in the event that the proposed Project operation exceeds the design limits (abnormal operations). Specifically, the plan would include procedures for the following situations:

- Responding to, investigating, and correcting the cause of the following:
  - Unintended closure of MLVs;
  - Increase or decrease in pressure or flow rate outside normal operating limits;
  - Notification of a pipeline rupture and/or NGL spill event;
  - Loss of communications;
  - Operation of any safety device; and
  - Any other foreseeable malfunction of a component, deviation from normal operation, or personnel error.
- Post-abnormal operation monitoring to determine continued integrity and safe operation of the pipeline;

- Notifying responsible operator personnel of an abnormal operation; or
- Periodically reviewing the response of operator personnel to determine the effectiveness of the procedures controlling abnormal operation and taking corrective action when deficiencies are found.

2.4 DECOMMISSIONING AND ABANDONMENT

The AGDC has indicated that the proposed Project could be operated up to 50 years, contingent on natural gas availability. The AGDC currently has no plans for future expansion of the facilities proposed. If additional demand for natural gas supplies requires future expansion, the AGDC would subsequently seek the appropriate authorizations from any federal, state, or local agencies. When and if an application is filed, the environmental impact of the new proposal would be examined at that time.

Upon reaching the end of the proposed Project's functional life, the pipeline would be shut down. Pipelines would be purged and cleaned. All aboveground facilities would be removed including compressor stations, piping, equipment, buildings, fencing, aboveground river crossing structures, access road culverts, and tanks. Aboveground pipelines would be removed to 1 foot below grade and underground pipelines would be capped and abandoned in place. Some belowground facilities, such as valves, may be excavated at certain locations. Gravel pads would be left in place. Materials that could be salvaged or recycled would be transported to instate and out-of-state facilities. Hazardous, solid, and liquid wastes would be properly disposed. After removal of facilities, cleared land would be contoured to restore appropriate grades and revegetated.

2.5 REFERENCES

AES. See ASRC Energy Services Alaska.

ASRC Energy Services Alaska (AES). 2012. Alaska Stand Alone Gas Pipeline/ASAP, Wetlands and Waters of the United States Delineation Report to Supplement the March 2011 Preliminary Jurisdictional Determination. Final, March 30, 2012. Alaska Gasline Development Corporation, Anchorage, AK.

BLM. See U.S. Bureau of Land Management.

U.S. Bureau of Land Management (BLM). 2002. Renewal of the Federal Grant for the Trans-Alaska Pipeline System Right-of-Way. Final Environmental Impact Statement. Volume 3: Sections 4.1 through 4.6. U.S. Department of the Interior. BLM/AK/PT-03/005+2880+990

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3.0 CONNECTED ACTIONS

The plan of development and operations for the proposed Project is based upon the assumption that a connected action that is not a part of the proposed Project, would occur prior to first operation of the ASAP in 2019. As defined by the National Environmental Policy Act (NEPA), connected actions are those actions closely related to the proposed Project and therefore should be discussed in the same impact statement. Actions are connected if they:

- Automatically trigger other actions which may require environmental impact statements;
- Cannot or will not proceed unless other actions are taken previously or simultaneously; or

Are interdependent parts of a larger action and depend on the larger action for their justification.

The connected action identified for the proposed Project is:

- Construction and operation of four aboveground pipelines that would connect the Prudhoe Bay Central Gas Facility to the gas conditioning facility (GCF) for supply of natural gas and natural gas liquids (NGLs), and return of bi-products.

The proposed Project would transport and distribute up to 500 MMscfd of natural gas and NGLs. The proposed Project could not operate as planned without the connected action in place. If an action would be unrealistic to exclude, it would be considered a connected action. Furthermore, the connected action would not occur if the proposed Project were not constructed and operated as planned. Therefore, the action would be connected to the proposed Project even though it would be planned and undertaken by other entities. Specific details are unknown at this time.

Several other actions are reasonably foreseeable if the proposed Project were to be constructed and operated. These reasonably foreseeable actions include:

- A distribution system for up to 60 MMscfd of natural gas at Fairbanks; the ASAP project would provide for natural gas off-take at the terminus of the Fairbanks Lateral. A Fairbanks distribution system would be constructed and operated by others.

- Future industrial gas use and/or liquefied natural gas (LNG) export of up to 130 MMscfd of natural gas in the Cook Inlet area; and

- Processing and distribution of 60 million standard cubic feet per day (MMscfd) of natural gas liquids from the Cook Inlet natural gas liquid extraction plant (NGLEP) facility located at the southern end of the mainline.

These reasonably foreseeable actions would be subject to appropriate project specific NEPA review and analysis at the time of their undertaking. Reasonably foreseeable actions, including these are further described and analyzed in Section 5.20, Cumulative Effects of this EIS.

3.1 PIPELINES CONNECTING PRUDHOE BAY CENTRAL GAS FACILITY TO ASAP GAS CONDITIONING FACILITY

Four primary pipelines would be constructed to connect the Prudhoe Bay Central Gas Facility (CGF) to the ASAP GCF as depicted in Figure 3.1-1. The pipelines would be used for the raw gas supply, the miscible injectant supply, the CO_2 return line, and the ethane return line. The distance between the two gas facilities would be approximately 1,000 feet (AGDC 2012b). The pipelines would be constructed during the winter and installed on vertical support members (VSMs) using standard practices for North Slope gas production, development, and operations. The VSMs would be similar to those for the ASAP mainline. Thus, the VSMs for the connecting lines would be 12 inches in diameter and 60 feet apart, giving a total of 17 VSMs for the 1,000-foot distance. The total area of ground disturbance for each VSM would be a circle 24 inches in diameter (AGDC 2012a). Sizing of the pipelines would be completed during the next phase of engineering. A skid mounted connection constructed by BP would be used to connect the pipelines to the CGF.

3.2 ENVIRONMENTAL EFFECTS OF CONNECTED ACTIONS

This section presents an analysis of potential environmental effects that could result from implementation of the connected action as defined herein. Construction and operation of four aboveground pipelines that would connect the Prudhoe Bay Central Gas Facility to the GCF for supply of natural gas and NGLs, and return of bi-products would require further definition, regulatory review and authorization prior to implementation. Further analysis under the NEPA could also be required, depending on specific construction and operation plans.

3.2.1 Soils and Geology

A temporary ice road would be constructed to stage and transport materials and equipment for the proposed VSM and pipeline construction area, which would minimize disturbance to the proposed Project area. Although thaw settlement could result if the ice road compaction of vegetation appreciably decreases the insulating capacity of the active layer (Felix et al. 1992), investigations addressing ice road impacts show impacts are confined to the vegetative layer, thereby limiting impacts to soils containing permafrost (Walker et al. 1987).

Vertical support members (VSMs) would be constructed and installed using standard practices for North Slope gas production, development, and operations. The VSMs would be similar to those for the ASAP mainline. Thus, the VSMs for the connecting lines would be 12 inches in diameter and 60 feet apart, giving a total of 17 VSMs for the 1,000-foot distance. The total area of ground and soil disturbance for each VSM would be a circle 24 inches in diameter, or a total area of approximately 70 square feet. No further impacts to geology and soils are anticipated from operations and maintenance activities.

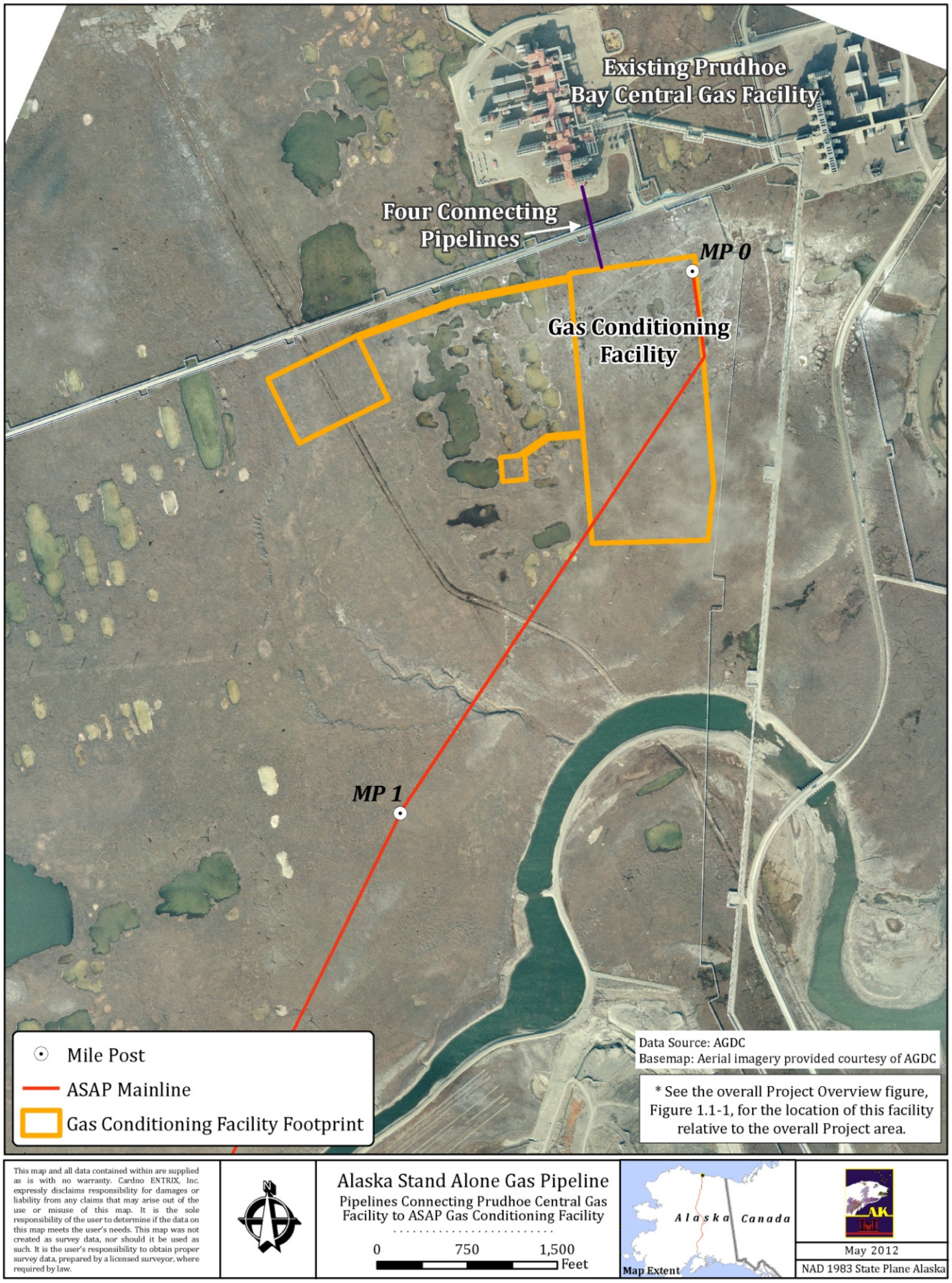

FIGURE 3.1-1 Pipelines Connecting Prudhoe Bay Central Gas Facility to ASAP Gas Conditioning Facility

3.2.2 Water Resources

Construction of the VSMs and elevated pipelines would not require excavation in waterbodies or stream crossings; therefore, impacts to water resources would be negligible. Operations and maintenance of the VSMs and elevated pipeline would also result in negligible impacts to water resources.

3.2.3 Terrestrial Vegetation

The proposed Project area is in an area of sedge/herbaceous wetland vegetation. Terrestrial vegetation would not be affected by construction and operation of the VSMs and pipelines.

3.2.4 Wetlands

Construction of VSMs and pipelines would be from an ice road, potentially resulting in the effects of compaction on underlying emergent wetlands (PEM1). The use of wide tracked vehicles would disperse the weight of the equipment over wetlands. The ice road and pipeline construction area would be limited to an area of approximately 2.3 acres. A total area of approximately 70 square feet of PEM1 emergent wetlands would be displaced by VSMs. Operations and maintenance of the pipeline would not result in additional impacts to vegetation.

3.2.5 Wildlife

The pipelines would be constructed in 1,000-foot-wide area between the Prudhoe Bay CGF and the proposed ASAP GCF. The area is bisected by an existing oil field service road and pipelines, within an area of high activity related to oil and gas production. The proposed Project area includes habitat types utilized by wading birds and caribou. Construction would occur during the winter months when migratory birds are not present, and when most of the caribou have left the oil field area. Construction of the VSMs and pipelines would result in 70 square feet of emergent herbaceous wetland habitat to be permanently lost to wildlife. Placement of the pipelines on VSMs approximately 7 feet above the ground would allow for wildlife movement during operations.

3.2.6 Fish

Construction of the VSMs and elevated pipelines would not require excavation in waterbodies or stream crossings; therefore, impacts to fish would be negligible.

3.2.7 Marine Mammals

The proposed Project would not affect marine mammals that are not listed as endangered, threatened, or candidate species under the Endangered Species Act (ESA) of 1973, or their habitats.

3.2.8 Threatened and Endangered Species

The VSMs and pipelines would be constructed within designated polar bear terrestrial denning critical habitat. No polar bear dens have been located within the proposed Project area in the past, and the proposed Project footprint does not contain the suitable macrohabitat characteristics for denning sites. Den sites would not likely be chosen in the proposed Project area due to the flat terrain and ongoing oilfield activity. The proposed Project would not likely adversely modify or destroy polar bear critical habitat. Compliance with regulations pertaining to polar bears for North Slope oil and gas operations would minimize potential impacts to the polar bear and its critical habitat.

At most, 2.3 acres of potential spectacled eider breeding habitat could be disturbed for the construction of the proposed Project. Approximately 70 square feet would be permanently lost for the construction of the VSMs and elevated pipeline. However, habitat loss is not likely to adversely affect spectacled eiders since nesting habitat for spectacled eiders is not limiting on the north slope of Alaska. Annual USFWS aerial surveys do not indicate that the proposed Project area is heavily used by spectacled eiders (USFWS 2008, see Figure 5.8-2 of Section 5.8, Threatened and Endangered Species) and previous site-specific nesting surveys from 1991 to 1995 do not indicate that breeding pairs of spectacled eiders have used the area for nesting (USFWS 2008, Figure 5.8-2, see Section 5.8, Threatened and Endangered Species). Construction of the VSMs and pipelines would occur during the winter when spectacled eiders are not present on the north slope of Alaska.

Construction and operation of the VSMs and pipelines could potentially affect Steller's eiders; however, no Steller's eiders have been verified nesting east of the Colville River since the 1970s. The proposed Project would therefore have no effect on Steller's eider nesting habitat or to nesting Steller's eiders.

Construction activities would occur during winter when yellow-billed loons are not present on the North Slope. Yellow-billed loon is not anticipated to nest in the vicinity of the proposed Project. Noise associated with operations and maintenance of the VSMs and pipelines could disturb a minimal number of non-breeding or brood-rearing yellow-billed loons if they use habitats in or near the proposed Project.

3.2.9 Land Use

The VSMs and pipelines would be within the exiting Prudhoe Bay oil and gas development area and would comply with applicable land use and land management plans.

3.2.10 Recreation

The VSMs and pipelines would be within the exiting Prudhoe Bay oil and gas development area. The area is restricted to oil and gas industry activities and would therefore not affect public recreational resources or activities.

3.2.11 Visual Resources

The VSMs and pipelines would be within the exiting Prudhoe Bay oil and gas development area. Visual qualities would be similar to existing pipelines and oil and gas facilities located within 1,000 feet of the proposed Project area. Therefore, impacts to visual resources would be negligible.

3.2.12 Socioeconomics

Construction of the VSMs and pipelines GCF would require a small work force during construction. It is expected that housing for these construction employees would be within Prudhoe Bay North Slope oil and gas operations facilities or in Deadhorse. Therefore, it is anticipated that these construction workers would have little to no impact on existing housing availability or cost within the area. Construction and operation of the pipelines is connected to the tax revenues that would be generated by the ASAP project.

3.2.13 Cultural Resources

No reported cultural resource sites would be located within the proposed construction footprint. Construction could affect undiscovered cultural resource sites in the VSM footprints. No direct effects would be expected from operation and maintenance.

3.2.14 Subsistence

Construction and operation of the VSMs and pipelines would occur within existing infrastructure of Prudhoe Bay. While construction and operation may displace resources such as caribou, there are no subsistence uses in the vicinity of the proposed VSMs and pipelines and potential subsistence impacts would be negligible.

3.2.15 Public Health

Construction and operation of the VSMs and pipelines would occur within existing infrastructure of Prudhoe Bay. Construction workers would comply with health and safety plans in place for oil and gas operations at Prudhoe. The area is restricted to oil and gas industry activities. Therefore, the proposed Project would not affect the health of the general public.

3.2.16 Air Quality

Negligible short term air emissions from construction equipment engines would occur during construction. There would be no impacts to air quality during operations.

3.2.17 Noise

In general, noise impacts from construction activities would be localized, intermittent, and short term. Noise at the construction site would range from 50-85 dBA at a distance of 50 feet from construction equipment. According to Table 5.17-2 (see Section 5.17, Air Quality), the nearest sensitive receptor would be the Prudhoe Bay Oil Field Complex (including the community of Deadhorse), approximately 3.6 miles from the proposed Project. The estimated noise levels from construction activities at this receptor would be approximately 55 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 5.17-4). During operations, noise levels would be negligible.

3.2.18 Navigation

Construction of the VSMs and elevated pipelines would not affect waterbodies, therefore impacts to navigation would not occur.

3.2.19 Reliability and Safety

The pipelines would be constructed and operated in accordance with industry standards consistent with other pipelines that exist nearby within the Prudhoe Bay oil and gas production area.

3.3 REFERENCES

AGDC. See Alaska Gasline Development Corporation.

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USFWS. See U.S. Fish and Wildlife Service.

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4.0 ALTERNATIVES

Implementation of the National Environmental Policy Act (NEPA) through the environmental impact statement (EIS) process requires consideration of reasonable alternatives[1] to the proposed Project that meet the purpose and need for the proposed Project while potentially reducing impacts to the natural and human environment. Consideration of the No Action Alternative is also required.

Sections 4.1 through 4.5 identify and examine potential alternatives to the proposed Project that were considered in the alternatives analysis, including alternatives raised during the scoping process. Potential alternatives are evaluated for:

- Consistency with the purpose and need for the proposed Project as stated in Section 1.2;
- Technical and logistical feasibility, and reasonableness; and
    - Environmental advantages over the proposed Project.

Several types of alternatives are considered:

- No Action Alternative (Section 4.1) – the proposed Project would not be constructed and would not operate;
- Energy Source Alternatives (Section 4.2) – energy alternatives and energy conservation measures that could reduce or eliminate the need for the North Slope natural gas and natural gas liquids (NGLs) that would be transported by the proposed Project;
- Natural Gas Transport System Alternatives (Section 4.3) – other systems that could transport the North Slope natural gas and NGLs that would be transported by the proposed Project;
- Pipeline Route Alternatives (Section 4.4) – alternative pipeline routes and route segment variations; and
    - Aboveground Facility Site Alternatives (Section 4.5) – alternative aboveground facility sites.

Section 4.6 presents a summary of potential alternatives and identifies reasonable alternatives that meet the purpose and need of the proposed Project, are technically feasible and have potential environmental advantages over the proposed Project. The cost of potential alternatives was not a consideration in the identification and evaluation of reasonable alternatives. Reasonable alternatives that are technically feasible and have potential

[1] Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant (CEQ 1981).

environmental advantages over the proposed Project are carried forward for detailed analysis as action alternatives throughout Section 5 of the EIS.

4.1 NO ACTION ALTERNATIVE

The No Action Alternative is defined as the proposed Project not being undertaken. The short-term and long-term environmental impacts identified in this EIS would not occur, as the proposed pipeline and associated aboveground facilities would not be constructed and 500 MMscfd of North Slope natural gas and NGLs would not be transported and made available to Fairbanks, Anchorage, and the Cook Inlet area. The current annual demand for Cook Inlet natural gas would remain at approximately 200 MMscfd, and future demand would grow to approximately 250 MMscfd by 2030. Fairbanks' current and future demand of 60 MMscfd would not be met. Energy conservation programs and new facilities that generate electricity and heat from sources other than natural gas could reduce, but not fully provide for the current and future demand for natural gas as the existing Cook Inlet supply would continue to diminish. As described in Section 1.2.2, the natural gas shortage is projected to become acute by 2015. Under the No Action Alternative, the proposed Project benefits would not be realized. These unrealized benefits would include: a reliable long term natural gas supply for Fairbanks and Southcentral Alaska; improved air quality in the Fairbanks area; revenues to the State of Alaska from gas sales, taxes and royalties; and jobs related to construction and operation of the proposed Project. The potential impacts of the No Action Alternative are analyzed in Sections 5.1 through 5.19.

4.2 ENERGY SOURCE ALTERNATIVES

The Alaska North Slope oil and gas fields are a proven, stable, and reliable source of natural gas and would be developed to supply natural gas and NGLs for the proposed Project by the scheduled 2019 start of pipeline operations. Discovered technically recoverable natural gas resources on the North Slope are estimated to be about 35 trillion cubic feet (TCF) (DOE 2009). These discovered technically recoverable natural gas resources are predominantly located in the Prudhoe Bay and Point Thomson fields. Energy sources other than North Slope natural gas were examined as potential alternatives to the proposed Project that could reduce or replace the need for natural gas and NGLs that would be transported by the proposed Project. Several alternative energy resources in the area of the proposed Project area are currently being developed or are in the planning and feasibility analysis process. These are described and examined in the following subsections.

4.2.1 Kenai Peninsula and Cook Inlet Natural Gas

Enhanced natural gas supplies could include potential future discovery in the Cook Inlet area and on the Kenai Peninsula. Although no significant discoveries of natural gas have occurred in Cook Inlet since the 1960s (ENSTAR 2008), exploration wells have been proposed or are being considered by several oil and gas lease holders. Escopeta Oil brought a jack-up drilling rig to

Cook Inlet and initiated an exploration well in September 2011 (Anchorage Daily News 2011a). According to a November 3, 2011, statement from Escopeta Oil, a single well drilled by the Spartan 151 rig reached a depth of 8,805 feet in the Inlet's Kitchen Lights Unit on October 28, 2011, discovering 46.7 billion cubic feet of natural gas (KTUU.com 2011). Work at the discovery well was then suspended until the spring of 2012. Until firm data are available from the discovery well and likely from several more confirmation wells the true potential of the discovery is not known (Mauer 2011). Drilling resumed in May, 2012 (Anchorage Daiuly News 2012a). Furie Operating Alaska LLC, formerly Escopeta Oil Co.,had not released further related public information as of October 1, 2012.

A second jack-up rig was proposed to facilitate additional Cook Inlet exploration (Anchorage Daily News 2011a). The jack up rig Endeavour arrived in lower Cook Inlet in early September, 2012. As of October 1, 2012, The Endeavour had not initiated drilling. New Kenai Peninsula and Cook Inlet natural gas reserves that could provide a long-term, stable supply of natural gas to markets in the Fairbanks and Cook Inlet areas remain unproven at this time.

4.2.2 Nenana Basin and/or Gubik Natural Gas

If new reserves are discovered in basins within or near the Railbelt Region[2] these could be an alternative to the proposed North Slope natural gas resource that would require fewer miles of pipeline. The Nenana Basin lies under an 8,500-square-mile area of lowlands, immediately west and northwest of the Parks Highway near the village of Nenana. In the summer of 2009, Doyon and Partners drilled an 11,100-foot deep exploration well about 5 miles west of the village of Nenana; while no commercial discovery was made, the presence of an operating petroleum system in the basin was confirmed (Alaska Journal of Commerce 2012). Although Doyon and Partners continues its Nenana Basin exploration program, the Nenana Basin remains an unproven source of gas (Petroleum News 2010b).

The Gubik gas field is a commercially unproven prospective gas field in the foothills of the Brooks Range. Based upon two wells drilled in 1951, the USGS estimated the total reserves of the Gubik gas field at 600 billion cubic feet of gas (Petroleum News 2009). In 2008 and 2009, Anadarko Petroleum drilled exploration and delineation wells in the known Gubik natural gas field, but did not drill in 2010 and has not announced future drilling plans (Petroleum News 2010a). In July 2011, Anadarko announced plans to conduct testing during Winter 2011 on one of the wells completed in 2009 (Anchorage Daily News 2011b).

4.2.3 Liquefied Natural Gas (LNG) Import

The liquefied natural gas (LNG) import alternative would require an LNG import terminal with marine access to LNG suppliers outside of Alaska. An LNG terminal, storage, and regasification facility would have to be constructed near Cook Inlet and connected to the

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[2] The Railbelt Region electrical grid is defined as the service areas of six regulated public utilities that extend from Fairbanks to Anchorage and the Kenai Peninsula. These utilities are Golden Valley Electric Association (GVEA); Chugach Electric Association (CEA); Matanuska Electric Association (MEA); Homer Electric Association (HEA); Anchorage Municipal Light & Power (ML&P); the City of Seward Electric System (SES); and Aurora Energy, LLC as an independent power producing utility. Sixty five percent of Alaskan population lies within the Railbelt Region.

existing natural gas pipeline system. LNG would have to be transported to the facility by tanker ships, regasified, and transported to market by the existing pipeline system. Although this alternative would provide LNG as a source of natural gas to meet Cook Inlet demand, it would not provide a new natural gas pipeline connection to Fairbanks, and would not utilize North Slope natural gas. Furthermore, the economic benefits of utilizing an in-state gas source would not be realized.

4.2.4 Hydroelectric Power

A hydroelectric project on the Susitna River has been studied for more than 50 years and is again being considered by the State of Alaska as a long-term source of energy. In the 1980s, the project was studied extensively by the Alaska Power Authority (APA) and a license application was submitted to the Federal Energy Regulatory Commission (FERC). The project was terminated in March 1986 due to difficulties related to developing a workable financing plan for a project of its scale, combined with the relatively low cost of gas-fired electricity in the Railbelt, the declining price of oil throughout the 1980s, and its resulting impacts upon the State budget.

In 2008, the Alaska State Legislature authorized the Alaska Energy Authority (AEA) to perform an update of the project plan (Black & Veatch 2010). The AEA is currently in the planning stages for a Susitna-Watana hydroelectric project with 600 MW of electrical power generating capacity. Operating restrictions and inefficiencies would result in the facility producing an average of about 300 MW per day. On December 29, 2011, AEA filed with the FERC its Notice of Intent (NOI) and Pre-Application Document (PAD) to start formal licensing for the proposed Susitna-Watana Hydroelectric Project, FERC No. 14241. The earliest estimated date the project could produce power is 2022.

If the Susitna-Watana hydroelectric project displaced the demand for natural gas electrical generation associated with the proposed pipeline Project, approximately 50 MMscfd of natural gas would be conserved. Therefore, the Susitna-Watana hydroelectric project could reduce demand by approximately 10 percent, but could not replace the 500 MMscfd that would be transported by the proposed Project to meet current and future demand.

Other identified potential hydroelectric projects could also reduce, but not replace, the existing and future need for natural gas, including Glacier Fork (75 MW), Chakachamna (330 MW) and several other projects in the 1 to 5 MW range.

4.2.5 Nuclear Power

Alutiiq LLC (Alutiiq) has been marketing a new small, modular nuclear power plant based upon an advanced reactor design from Hyperion Power Generation (Hyperion) and Los Alamos National Laboratory. Alutiiq has approached the Chugach Electric Association Inc. about the development of a modular nuclear power plant for the specific purpose of repowering at the existing Beluga power plant site (a 374-MW natural gas-fired plant). The thermal output from the reactor would be converted to approximately 27 MW of electrical output through a steam turbine generator. If the Beluga nuclear power plant project moved forward, 2020 is the estimated timeframe for the start of electrical generation (Black & Veatch 2010). The project could somewhat reduce, but not completely replace, the existing and future needs for natural gas to provide the remaining 347 MW of existing natural gas fired power production. Further, the Beluga power plant project is uncertain and would not be developed within a timeframe that would meet the proposed Project's objectives.

4.2.6 Coal and Coal Gas

The existing Healy Clean Coal Project (HCCP) operated briefly following its construction as part of a demonstration program, but has been shut down since 2000. The HCCP has an electrical output capacity of 50 MW (GVEA 2011). An operational HCCP could reduce, but not replace existing and future needs for natural gas. Restarting the Healy Clean Coal electrical generating facility is being considered and the ADEC recently issued a permit for the restart of that project.

The proposed Accelergy/Tyonek Coal-to-Liquids (CTL Project) (CTL) would produce aviation fuel, as well as gasoline and diesel for military and industrial uses, and would generate 200 MW to 400 MW of electricity from waste heat. However, up to 200 MMscfd of natural gas could be used in the CTL process (AGDC 2011a, Attachment A).

Several new pulverized coal power generating facilities have been proposed within the Railbelt Region of Alaska. The Usibelli Coal Mine, located south of Fairbanks, provides an available source of coal, and is currently the only operational coal mine in Alaska (Usibelli 2011). Undeveloped coal resources exist at the proposed Chuitna Coal Mine and surrounding areas near Beluga, and at other sites within Alaska. Coal-generated electrical power could reduce existing daily natural gas demand.

Other coal technologies such as integrated gasification combined cycle (IGCC) or carbon capture and sequestration (CCS) could also be considered. These technologies could produce synthetic gas as well as electric power. However, these technologies are not sufficiently developed to significantly penetrate the coal-generation market. As such, coal projects could reduce, but not replace, existing and future needs for natural gas.

4.2.7 Renewable Sources (Wind, Geothermal, Biomass, and Tidal)

A number of projects that would generate electric power from renewable resources have been identified and are in various stages of planning or implementation. These projects, which could reduce, but not replace because of their limited sizes, the existing and future need for natural gas that would be provided by the proposed Project are listed in Table 4.2-1 (Black & Veatch 2010).

TABLE 4.2-1 Potential Renewable Energy Projects

Project	Capacity	Current Phase
Fire Island Wind Project	54 MW	Construction
Nikiski Wind Project	15 MW	Planning
GVEA Eva Creek Wind Project	24 MW	Construction
Mt. Spurr Geothermal Project	50-100 MW	Resource evaluation
Anchorage MSW mass burn	22 MW	Planning
GVEA MSW mass burn	4 MW	Planning
Turnagain Arm Tidal Project	Up to 1,200 MW	Planning (experimental technology – post 2020 implementation)

MSW = municipal solid waste.
Source: Black and Veatch (2010).

4.2.8 Energy Conservation Measures and Programs

Upgrading and replacing older, less efficient natural gas-powered electric generation facilities with current technology would improve efficiency of natural gas generation. The Southcentral Power Project and Golden Valley Electric Association (GVEA) North Pole Retrofit Project are proposed projects that would improve the efficiency of natural gas fired power generation in the Railbelt and permit the retirement of aging units. Demand-side management and energy efficiency (DSM/EE) measures can reduce capacity requirements and annual energy requirements. Federal, state, and utility sponsored programs that encourage and reward consumers to implement energy conservation are ongoing in Alaska. Implementation of enhanced DSM/EE programs could result in a reduction of the region's capacity requirements by approximately 8 percent. A similar level of impact would also be expected for annual energy requirements (Black & Veatch 2010).

4.2.9 Alternative Energy Sources – Summary and Conclusions

Table 4.2-2 provides a summary of alternative energy sources in relationship to components of the proposed Project purpose and need. Energy sources other than North Slope natural gas and NGLs could reduce but not replace the volume of gas or the electrical power generating capacity of the gas that would be transported by the proposed Project. None of the identified energy alternatives would meet all objectives of the proposed Project purpose and need. Although some projects would provide alternative means for generating electrical power, they would only individually and collectively partially replace the electrical power generating capacity of the gas that would be transported by the proposed Project, and they would not provide the natural gas needed for home and institutional heating and industrial purposes. Some of the energy alternatives are unproven or could not be realized by 2019, which is the planned in-service date for the proposed Project. Additionally, the economic benefits of utilizing an in-state gas source would not be realized by several of the alternatives. Alternative energy projects are likely to be developed independently of the proposed Project and are discussed further in Section 5.20, Cumulative Effects.

TABLE 4.2-2 Summary of Alternative Energy Sources Relative to the Proposed Project Purpose and Need Statement

Energy Source	A long-term, stable supply of up to 500 MMscfd of natural gas and NGLs	Deliverable to markets in the Fairbanks and Cook Inlet areas	Deliverable by 2019	Utilize proven gas supplies that provide economic benefit to the State through royalties and taxes	Other Considerations
Kenai Peninsula and Cook Inlet natural gas (new production)	no	no	no	no	Speculative
Gubik and/or Nenana Field natural gas	no	no	no	no	Speculative
LNG Import	yes	yes	yes	no	Distribution to Fairbanks would be limited to truck/trailer
Hydroelectric Power from Susitna-Watana, Chakachamna or other new projects	no	yes	no	no	Would provide only electrical power
Coal and/or coal gas	no	yes	yes	no	Would provide electrical power, synthetic gas from IGCC process is speculative
Renewable Sources (Wind, Geothermal, Tidal)	no	yes	yes	no	Would provide only electrical power
Nuclear Power	no	no	no	no	Would provide only electrical power
Energy Conservation Measures and Programs	no	yes	yes	no	Could reduce natural gas consumption by up to 8 percent.

4.3 NATURAL GAS TRANSPORT SYSTEM ALTERNATIVES

Pipelines are cost-effective means of transporting large volumes of natural gas over long distances for sustained periods of time. This section examines alternatives to the proposed 24-inch diameter Project pipeline that would have the potential to meet the purpose and need for the proposed Project and minimize environmental effects. Transportation system alternatives are alternatives to the proposed Project that would make use of existing, modified, or proposed natural gas delivery systems to meet the stated objectives of the proposed Project.

4.3.1 Dry Gas Pipeline from North Slope Alternative

This alternative would include a NGL extraction plant (NGLEP) facility at the gas conditioning facility (GCF) to remove NGLs and return them to the Prudhoe Bay central gas facility (CGF) on the North Slope to provide utility grade natural gas for pipeline transport. NGLs including propane and heavier components would be removed and re-injected in wells on the North Slope. A NGLEP facility at the pipeline terminus near Wasilla would not be required, and transmission, process and distribution of 60 MMscfd of NGLs as described in Section 5.20, Cumulative Effects would not take place. The proposed straddle facility near Dunbar would include an off-take for the Fairbanks Lateral, but would not require facilities to remove and re-inject NGLs. A dry gas pipeline project would not require the Cook Inlet NGLEP Facility or the reasonably foreseeable NGL pipeline, fractionation plant and storage facility at Nikiski. Accordingly, there would be a reduction in overall proposed Project impacts and cumulative impacts in the Cook Inlet area for the dry gas pipeline alternative when compared to the proposed Project.

The purpose and need of the proposed Project includes the transport of NGLs for sale and distribution at the pipeline terminus. The AGDC has stated that the value of the NGL component would be important to the economic performance of the proposed Project (AGDC 2010a). Thus, the purpose and need of the proposed Project would not be met by a dry gas pipeline that would not provide NGLs at the pipeline terminus.

4.3.2 Smaller Diameter Pipeline Alternative

A smaller diameter pipeline with additional compression was examined to evaluate if a reduction in proposed Project construction and permanent right-of-way (ROW) footprint and corresponding reduction in impacts to associated environmental resources could be achieved. The optimum diameter of the pipeline is a function of the intended continuous peak capacity, the operating pressure, the cost (capital and operating) and the required operating facilities. With increased compression (maintaining higher operating pressure), the required diameter of the pipeline may be decreased. However, to increase and maintain compression across the length of the over 737-mile long pipeline, more compressor stations (with attendant costs and environmental impacts) would be required.

Analysis indicated that the optimum pipeline diameter in terms of cost and environmental impact considerations for the proposed 500 MMscfd, 737 mile long pipeline Project would be between 18 and 24 inches (AGDC 2010b). However, there would be tradeoffs associated with system expandability, reliability, and cost of equipment for a configuration smaller than a 24-inch diameter. For example, one or two compressor stations would be required for the proposed 24-inch diameter pipeline. Conversely, with similar flow and pressure limitations, a 20-inch diameter pipeline would require three compressor stations, and an 18-inch diameter pipeline would require six compressor stations. Although it is technically possible to reduce the pipeline diameter to less than 18 inches, doing so would require an excessive number of compressor stations (e.g., 12 compressor stations for a 16-inch diameter pipeline) and a cascading series of safety, proximity, design, and facility issues and changes, to the point that such a design would be neither cost effective nor practicable.

The construction methods and associated construction right-of-way (ROW) for an 18- to 24-inch diameter pipeline would be virtually the same (AGDC 2010b). Each additional compressor station would add approximately 1.5 to 2.0 acres disturbance and additional quantities of air, wastewater, and solid and hazardous waste emissions would be generated. Therefore, a smaller diameter gas pipeline would not include features that would lessen environmental impacts when compared to the proposed Project.

4.3.3 Spur Pipeline From a Large North Slope-to-Lower 48 or Valdez Pipeline

The Alaska Pipeline Project (APP) has been proposed by TransCanada Alaska Company, LLC and ExxonMobil Corporation. The APP would be a 48-inch diameter pipeline and would operate at 2,500 psig. As part of the proposed APP, a natural gas pipeline would connect from the Point Thomson field to a new gas treatment plant (GTP) to be constructed near existing Prudhoe Bay facilities. The GTP would be initially designed to process up to 5.3 bcf/d of raw natural gas into up to 4.5 bcf/d of pipeline quality gas.

From the GTP, two alternative routes have been proposed for the pipeline, the Alberta option and the Valdez LNG option. The Alaska portion of the Alberta option would be 745 miles long and would have a base design capacity of 4.5 bcf/d and a maximum compression design capacity of 5.9 bcf/d. This option would start at the GTP and would follow the existing TAPS alignment to points near Fairbanks and Delta Junction. It then would follow the alignment of the Alaska Highway until reaching the Alaska-Canada border, and would then extend through Canada.

The alternative pipeline route, the Valdez LNG option, would be 811 miles long, with a base design capacity of 3.0 bcf/d. This option also would extend from Prudhoe Bay through points near Fairbanks and Delta Junction, but then would diverge to LNG facilities (to be built by third parties) near Valdez, Alaska.

Regardless of the selected pipeline option, a minimum of five off-take connections would be built into the pipeline to allow local natural gas suppliers to obtain product to meet local community needs. These connections could be used to construct Spur Pipelines to serve Fairbanks and the Cook Inlet area. For both the Alberta and Valdez LNG option, a spur line could connect near Livengood or Fox, and follow the proposed Project route to the Cook Inlet area. For the Valdez LNG Option, a spur line to serve Fairbanks could connect near Fox, and a spur line to serve the Cook Inlet area could connect near Glennallen.

TransCanada conducted a FERC-approved open season in May through July 2010 to identify potential shippers. They then entered into the FERC's pre-filing process, conducting field studies and other environmental work, with the intent of submitting their FERC permit application for the Alberta option in the fourth quarter of 2012.

In March 2012 APP and Alaska North Slope gas producers ConocoPhillips and BP agreed to work together on evaluating options for a large-scale LNG export facility from Southcentral Alaska as an alternative to a natural gas pipeline through Alberta. In addition to Valdez, Nikiski is also being considered for the location of an LNG export facility. The evaluation process schedule for a large-scale LNG export facility from Southcentral Alaska is such that by September 2012 TransCanada should have completed initial work on a plan for an LNG project. By the end of the year, it should have completed a serious assessment of interest in the project from "all potential market participants." The filing deadline for a FERC permit application has been extended by 2 years, to the fourth quarter of 2014 (Anchorage Daily News 2012b).

The APP and evaluation of a large-scale LNG export facility from Southcentral Alaska as an alternative to a natural gas pipeline through Alberta, is in the planning process and a pipeline is not currently scheduled to be completed and transporting natural gas by 2019[3]. Furthermore, implementation of an APP is uncertain. Therefore, the Spur Pipeline from a North Slope-to-Lower 48 or Valdez Pipeline would not meet the purpose and need of the proposed Project.

4.3.4 Pipeline from North Slope to Fairbanks, Transport by Rail Car to Southcentral Alaska

This alternative would involve the proposed Project terminating at a new LNG conversion/production facility near Fairbanks, located near the northern reach of the Alaska Railroad. After conversion, the LNG would be transported by rail car on the existing Alaska Railroad to new LNG storage and gasification facilities near Anchorage, which would have access to the existing Southcentral Alaska natural gas distribution system.

Transshipping LNG by rail has been accomplished by use of 82-foot long, 34,500 gallon gross capacity rail cars. Each rail car has the capacity to carry LNG that when gasified would amount to approximately 2.5 MMscf. Therefore, approximately 176 rail cars per day (equivalent to about three unit trains per day, one way, each almost 1 mile long) would be required to transport 440 MMscfd of natural gas as LNG from Fairbanks to Southcentral Alaska. This alternative would not be a logistically practicable means of moving large volumes of LNG from Fairbanks to Southcentral Alaska for 30 or more years. Therefore, the pipeline from North Slope to Fairbanks, transport by rail car to Southcentral Alaska alternative would not be a reasonable alternative.

4.3.5 Transport by Truck/Trailer

This alternative would involve conversion of natural gas to LNG at a new production facility on the North Slope and subsequent transport of LNG by truck/trailer via the Dalton, Elliott, Steese, and Parks highways to new LNG storage and gasification facilities in Fairbanks and Southcentral Alaska. Fairbanks Natural Gas is working on a plan to truck natural gas as LNG to Fairbanks from the North Slope (Fairbanks Daily News-Miner 2011). The transport of 500 MMscfd of natural gas that has been converted to LNG via truck/trailer would require trucking on a much larger scale than that proposed by Fairbanks Natural Gas.

Transshipping LNG by truck/trailer has been accomplished by use of 44 foot long, 13,000 gallon gross capacity trailers. Each trailer has the capacity to carry LNG that when gasified would amount to approximately 1 MMscf of natural gas. Therefore approximately 500 trailers per day would be required to transport 500 MMscfd. This would require one loaded trailer leaving a North Slope LNG facility approximately every 3 minutes around the clock. Thus, this alternative would not be logistically practical or reasonable.

[3] The estimate for APP first gas was mid-2020 prior to extension of the FERC permit application filing deadline by 2 years (APP 2011).

4.4 PIPELINE ROUTE ALTERNATIVES

Approximately 82 percent of the proposed Project route would closely parallel existing pipeline, highway, or railroad ROWs (AGDC 2011a). Locating linear utility and transportation infrastructure projects in close proximity to each other is a desirable means of concentrating development within established corridors and minimizing environmental impacts, and is referred to as co-location. A major route alternative is defined as a generally longer segment of ROW that would follow a route different from the proposed pipeline. Route variations differ from major route alternatives in that they are identified to resolve or reduce construction impacts to specific, localized resources such as cultural resources sites, wetlands, streams, recreational lands, residences, or terrain conditions. Major route alternatives and route variations that would be co-located with other established corridors were examined as potential alternatives to the proposed Project route. Several established linear corridors associated with roads, railroad, pipeline, and transmission lines exist in the proposed Project area and are depicted in Figure 4.4-1.

4.4.1 Major Route Alternatives

4.4.1.1 Richardson Highway Route Alternative

Under the Richardson Highway Route Alternative (see Figure 4.4-1), the 24-inch diameter pipeline would follow the proposed Project route for approximately 405 miles to Livengood. The route alternative would then proceed southeast to Fairbanks adjacent to the TAPS ROW, then parallel the Richardson Highway up the Tanana River Valley. After crossing the Tanana River Valley at Delta, the route alternative would turn southward, paralleling the Richardson Highway, then follow the Delta River Valley into the Alaska Range, where it would cross through Isabel Pass, continuing generally southward, crossing the Gulkana River. In the Gulkana area, the route alternative would turn southwest, join the Glenn Highway, then turn west and south to generally follow the Glenn Highway. Near the Eureka Roadhouse, the route alternative would leave the highway and follow Caribou Creek to Chitna Pass, then Boulder Creek to Chickaloon, then generally parallel the Glenn Highway along the Matanuska River to near Palmer, then overland, terminating at ENSTAR's Beluga Pipeline (Beluga Pipeline MP 55). The Richardson Highway Route Alternative is depicted in Figure 4.4-1[4].

The distance of the Richardson Highway Route Alternative between Livengood and the termination of the route alternative would be approximately 440 miles, resulting in an overall route alternative length of approximately 845 miles. Connection to Fairbanks would be accomplished by a 12-inch diameter lateral pipeline that would extend 32 miles from south of Eielson Air Force Base to Fairbanks. The pipeline and lateral would be buried throughout, except at compressor stations, metering stations, and certain river crossings and faults.

[4] The proposed Project is identified as 'Proposed ASAP Pipeline'.

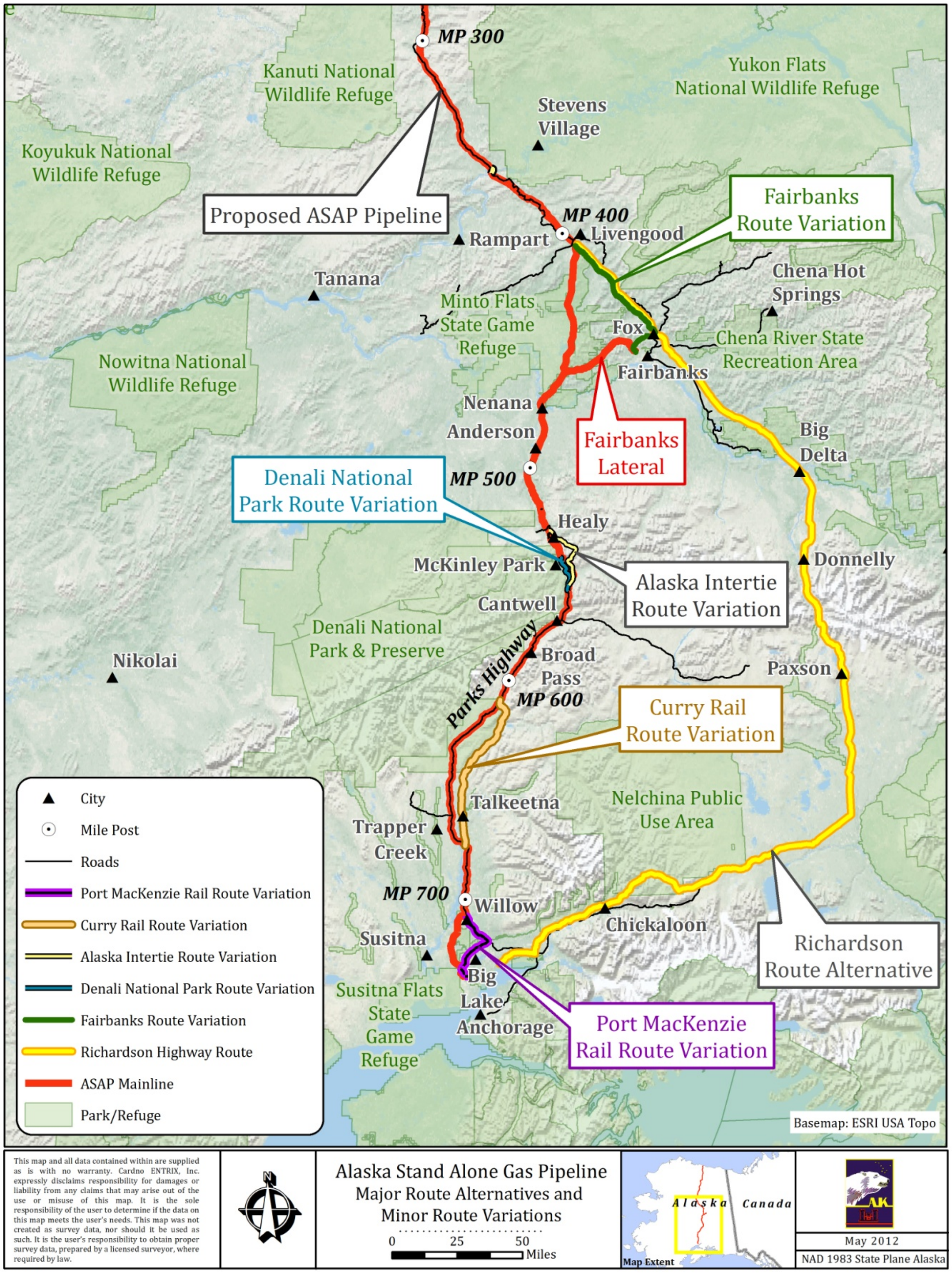

FIGURE 4.4-1 Major Route Alternatives and Minor Route Variations

A Parks Highway Route and the Richardson Highway Route Alternative were examined in the 2009 Stand Alone Pipeline Alternatives Analysis conducted by the State of Alaska (State of Alaska 2009). The 753 mile long Parks Highway Route considered in the analysis was subsequently refined to the 737 mile long route (the proposed Project). The State of Alaska found that constructing a pipeline along the Richardson Highway Route would cost approximately 10 percent more than along the Parks Highway Route. The Richardson Highway route would be longer by 92 miles (845 miles long versus 753 miles) and would cross a greater number of streams (515 versus 480), and two mountain ranges. As a result of the increased length, the Richardson Highway Route Alternative would impact 23 percent more wetland features (730 features versus 593 features), 35 percent more wetland habitat (1,735 wetland acres versus 1,288 acres), and a greater number of wetland acres of each wetland type than the Parks Highway Route that was studied in the Alternatives Analysis conducted by the State of Alaska (AGDC 2011b). Under the Richardson Highway Route Alternative, the lateral pipeline from south of Eielson Air Force Base to Fairbanks would be 3 miles shorter than the Fairbanks Lateral associated with the proposed Project (32 miles long verses 35 miles). A summary comparing the Parks Highway Route and the Richardson Highway Route is presented in Table 4.4-1 (State of Alaska 2009).

Based upon this screening analysis, the Richardson Highway Route Alternative does not appear to include features that would result in less environmental impacts when compared to the Parks Highway Route. The route of the proposed Project is a refinement of the Parks Highway Route that was the subject of the Alternatives Analysis conducted by the State of Alaska in 2009. For the proposed Project, the Parks Highway Route was refined and shortened by an additional 16 miles, indicating further reduction in overall impacts. Therefore, the Richardson Highway Route Alternative would not present environmental advantages over the proposed Project.

TABLE 4.4-1 Parks Highway Route and Richardson Highway Route Alternatives Comparison Summary

Feature	Parks Highway Route	Richardson Highway Route
Length (miles)	753	845
Stream Crossings (number)	434	512
Road Crossings (number)	67	95
Hilly Terrain (miles)	295	449
Active Faults (number)	7	7
Wetland Features (number)	593	730
Wetland (acres within a 30 ft ROW)	1,288	1,735
Fish Stream Crossings (number)	480	515
Subsistence Areas (miles traversed)	540	560
Waterfowl Habitat (miles)	200	250
Raptor/Eagle Nesting Habitat (miles)	100	115
Moose Winter Habitat (miles)	211	425

TABLE 4.4-1 Parks Highway Route and Richardson Highway Route Alternatives Comparison Summary

Feature	Parks Highway Route	Richardson Highway Route
Caribou Migration Habitat (miles)	180	270
Brown Bear Habitat (miles)	105	120
Cultural Resource Sites (number of known sites within the area of potential effect)	405	450
Communities / Population (number)	33 /372,600	47 / 380,900

Source: Stand Alone Pipeline Alternatives Analysis (State of Alaska 2009).

4.4.2 Route Variations

4.4.2.1 Fairbanks Route Variation

The Fairbanks Route Variation would avoid the Minto Flats segment of the proposed Project that would extend from Livengood (MP 405) to Dunbar (MP 458). The Fairbanks Route Variation would begin in Livengood near MP 405 roughly following the Elliott Highway and the TAPS corridors approximately 50.5 miles to Fox. The route variation then would follow Goldstream Creek for approximately 9 miles and finally would cross the Alaska Railroad (ARR) and Sheep Creek Road where a straddle and off-take facility similar to the straddle and off-take facility proposed at Dunbar as a component of the proposed Project would be located. The route variation would include about 2 miles of 12-inch pipe from the straddle and off-take facility to a terminus that would connect to a future gas distribution system in Fairbanks. The 24-inch line would return from the straddle and off-take facility along the same route for 1.2 miles and then turn west paralleling the ARR for roughly 32 miles to Dunbar at MP 458 (the 32-mile segment would follow the same alignment as the proposed Fairbanks Lateral from Dunbar to Fairbanks). The need for a separate Fairbanks Lateral would be eliminated under this route variation. The route variation would consist of 93.5 miles of 24-inch pipeline and 2 miles of 12-inch pipe, for a total of 95.5 miles in length (Figure 4.4-1). Without the Dunbar to Fairbanks segment that would be common to both the proposed Project route and the Fairbanks Route Variation, the length would be 61.1 miles. The temporary construction easement (TCE) for the Fairbanks Route Variation would be consistent with the proposed Project, generally 100-feet wide with segments of up to 230-feet wide in sloped areas where extensive earthwork would be required.

The alternatives study phase that resulted in the Stand Alone Gas Pipeline Route Alternatives Analysis (State of Alaska 2009) identified numerous conditions along this route that are not conducive to pipeline construction. Unfavorable site elements identified along this route variation included constructability constraints resulting from unfavorable geotechnical conditions (e.g., permafrost), as well as the presence of excessively rugged terrain throughout the northwest segment of the route variation. Figure 4.4-2 illustrates the differences in the ruggedness of the Fairbanks Route Variation compared to the corresponding Minto Route segment.

Other issues of concern for the Fairbanks Route Variation were identified by the AGDC during their route development process for the proposed Project (AGDC 2011a, Attachment B) including:

- The Fairbanks Route Variation would be 8.1 miles longer (61.1 miles as opposed to the 53 mile segment that it would replace), which would increase cost and net environmental effects when compared to the corresponding proposed Minto Route segment; and
- The need for a straddle and off-take facility that would be located in the Fairbanks area within an EPA air quality non-attainment area, which would present more complex and costly permitting and compliance than for the proposed straddle and off-take facility located in Dunbar (see Section 5.16 for further details regarding the Fairbanks air quality non-attainment area).

Locating the straddle and off-take facility west of the non-attainment area would require an additional lateral pipeline that would be minimum of 5 miles in length provided that a suitable site could be found in the Goldstream Creek drainage area. Locating the straddle and off-take facility north of the non-attainment area would require an additional lateral pipeline that would be minimum of 10 miles in length provided that a suitable site could be found along the Elliott Highway.

In October 2011, the AGDC conducted a desktop delineation and classification of wetlands along the Fairbanks Route Variation. The desktop study utilized the same resources and methodologies that were used to complete wetland delineations and classification for the proposed Project (AGDC 2011c, 2011d).

In association with the wetlands analysis conducted in October 2011, the AGDC also refined the Fairbanks Route Variation and the proposed Minto Route segment TCEs by identifying and defining specific areas that would be wider than 100 feet. Temporary extra work spaces (TEWS) were also identified and defined for both the Fairbanks Route Variation and the proposed Minto Route segment. The TEWS would be located immediately adjacent to the TCEs, and would generally be 150 feet by 50 feet, or 300 feet by 80 feet each in dimensions.

Based upon the wetlands analysis, and considering the refined TCEs and TEWS, the AGDC determined the Fairbanks Route Variation would have 399 acres of wetlands within the TCEs and TEWS. The corresponding proposed Minto Route segment would have 361 acres within the TCEs and TEWS (AGDC 2011c). A comparative summary of environmental features within the Fairbanks Route Variation and the proposed Minto Route segment is provided in Table 4.4-2.

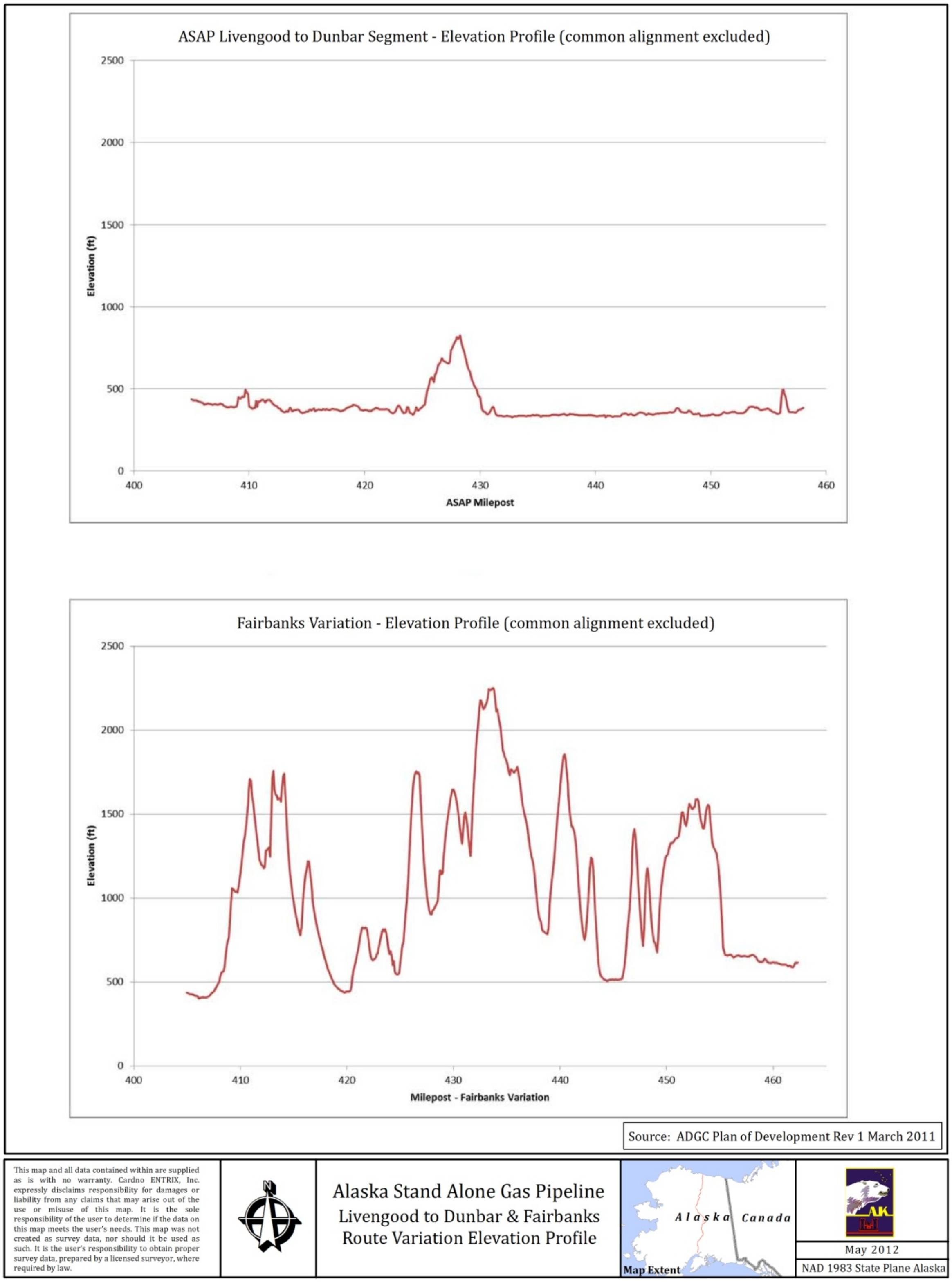

FIGURE 4.4-2 Livengood to Dunbar & Fairbanks Route Variation Elevation Profiles

Based upon the information presented herein, the Fairbanks Route Variation would be 8.1 miles longer than the proposed Minto Route segment, would have a greater effect on environmental resources as indicated in Table 4.4-2, and would traverse through the middle of a residential area. Therefore, the Fairbanks Route Variation would not present net environmental benefits over the proposed Project route for this segment as the advantages to some key resources are outweighed by increased potential impacts to other key resources.

TABLE 4.4-2 Environmental Features within the Proposed Minto Route Segment and Fairbanks Route Variation

Feature	Proposed Minto Route Segment	Fairbanks Route Variation
Pipeline Length (miles)	53 [a]	61.1 [a]
Elevation Change (feet)	450 [b]	1,848 [b]
Slopes greater than 5 Percent (miles)	8 [b]	20 [b]
Boreal Forest within TCE and TEWS (acres)	444 [c]	821 [c]
Wetlands within TCE and TEWS (acres)	361 [b]	399 [b]
Stream Crossings	39 [d]	46 [d]
Road Crossings	1 [b]	18 [b]
Straddle and Off-Take Facility Location	Outside of Fairbanks air quality non-attainment area [e]	Within Fairbanks air quality non-attainment area [e]

[a] Does not include the segment from Dunbar to Fairbanks that would be required for both options.
[b] AGDC 2011c.
[c] Data summarized from the 2008 LANDFIRE Existing Vegetation layer for the State of Alaska.
[d] AGDC 2011a.
[e] The Fairbanks area is an EPA designated non-attainment area for particulate matter air quality standards.

4.4.2.2 Alaska Intertie Route Variation

The Alaska Intertie Route Variation would avoid Denali National Park and Preserve (NPP). The route would depart the Parks Highway in the vicinity of Healy (MP 530) and would generally follow drainages east of Sugar Loaf Mountain and the Alaska Intertie (the Anchorage – Fairbanks intertie transmission line corridor) before crossing the Yanert Fork and returning to the Parks Highway at MP 553 (Figure 4.4-3[5]). The terrain on the east side of Sugar Loaf Mountain is deeply dissected by steep drainages flowing directly into Moody Creek. The terrain is so steep that the Intertie towers were placed on the flanks of Sugar Loaf Mountain without aid of surface transportation. A summary report by ENSTAR concluded a route around the east side of Sugar Loaf Mountain was not practicable for a variety of reasons including rugged terrain; significant engineering, construction, and maintenance challenges; and lack of road access (ENSTAR 2008). An alignment was identified further west that also would avoid the Denali NPP (now the proposed Project route). The Alaska Intertie Route Variation is not considered practical or feasible from the technical standpoint and is therefore not a reasonable route variation alternative.

[5] The proposed Project is identified as 'ASAP Mainline' on this figure.

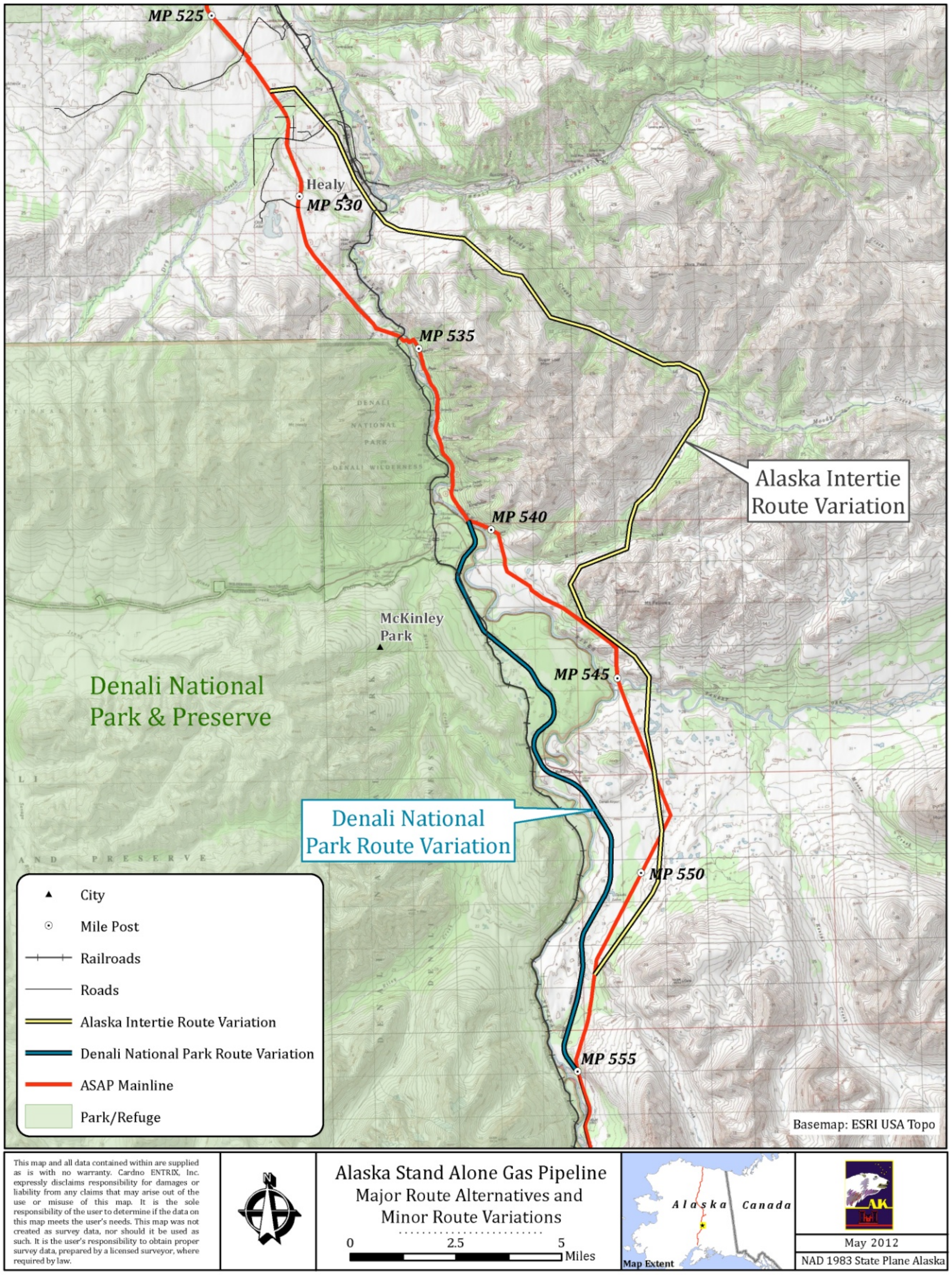

FIGURE 4.4-3 Denali National Park Route Variation and Alaska Intertie Route Variation

4.4.2.3 Denali National Park Route Variation

The proposed Project route in the vicinity of Denali NPP would traverse east of the Nenana River and would avoid Denali NPP lands. The proposed route would involve steep slopes and potential visual impacts when viewed from Denali NPP. The Denali National Park Route Variation would parallel the Parks Highway corridor through Denali NPP, avoid the slopes east of the highway and potentially minimize visual impacts. The route variation would leave the proposed Project route near MP 540 (Figure 4.4-3). The Denali National Park Route Variation would be in close proximity to the Parks Highway from MP 540 to MP 555. Typical pipeline installation associated with this route variation would be within the roadside ditch near the toe of the east road slope. South of the Denali Park commercial area, the pipeline would cross the Nenana River on the pedestrian/bicycle bridge and enter the Denali NPP. The route variation would cross under the highway north of the junction with the Denali Park Road and then continue south following the Parks Highway corridor. The route variation would cross the Nenana River at McKinley Village and continue south within the Parks Highway ROW. The Denali National Park Route Variation would have two major river crossings: Nenana River using the existing pedestrian/bike bridge south of the Denali Park commercial area, and Nenana River by McKinley Village (buried) (ENSTAR 2008). If the Denali National Park Route Variation were to be constructed, it would be during the winter when there is very little commercial and recreational activity in the Denali Park commercial area.

The Denali National Park Route Variation would be approximately 15.3 miles long and would be within the Denali NPP for approximately 7 miles, but would stay in the Parks Highway ROW. None of the Denali National Park lands that would be crossed are designated wilderness areas. Currently, federal laws would not allow construction of this route variation within Denali National Park (see further discussion of applicable National Park Service regulations in Section 1.2.5.2). Federal legislation that would allow the route variation has been introduced by the Alaska Congressional Delegation, and is currently being considered by the U.S. Congress. If such legislation is passed into law, the NPS would have authority to issue a ROW permit for a pipeline route which would result in the fewest or least severe adverse impacts upon the Park. For this reason, the description of the Denali National Park Route Variation includes the provision that the AGDC would work with the NPS to adjust and refine the proposed route variation through Denali National Park to assure that the route or mode would be constructed that would result in the fewest or least severe adverse impacts.

The 15.3 mile long Denali National Park Route Variation would replace a 15.5-mile long segment of the proposed Project between approximately MP 540 and MP 555. Wetland and riverine impacts associated with this route variation would be approximately 3.5 acres, or less than 2 percent of the total area affected. The corresponding proposed Project segment would require removal of trees and vegetation on a steep slope and elevated bench that would be visible from Denali NPP and the Parks Highway. The Denali National Park Route Variation would be of similar length and would be co-located with the Parks Highway. Therefore, the Denali National Park Route Variation is a reasonable alternative that could minimize visual impacts in the area of Denali NPP. Further detailed maps can be viewed on AGDC's website http://www.agdc.us/overview/map.

4.4.2.4 Alaska Railroad Route Variations

Several potential route variations that would be co-located with segments of the existing Alaska Railroad were identified during scoping, including potential co-location with the rail line near Curry, and with the proposed Port MacKenzie Rail Extension Project near Houston. These routes were examined for their potential to reduce the length of the pipeline, wetland impacts, and stream crossings.

Curry Rail Route Variation

The Curry Rail Route Variation would follow the existing ARR ROW from where it would cross the Parks Highway at MP 608.5 north of Curry Ridge, and would extend south along the east side of the Curry Ridge, crossing the Susitna River, then extending along the east side of the Susitna River past the former town of Curry. The route variation would cross the Talkeetna River north of Talkeetna, and extend through Talkeetna south, where it would rejoin the Parks Highway Corridor at MP 677.8 (Figure 4.4-4[6]). The Curry Rail Route Variation would comply with the directive of Alaska Statute (AS) 38.34 to use state land and existing state highway and railroad ROW to the maximum extent feasible, and would also avoid lands acquired by use of grants provided through the Land and Water Conservation Act (LWCF 6[f] lands) in Denali Sate Park.

Co-locating with the railroad ROW would require a new 100-foot wide construction ROW located east of the rail line for a distance of 65.6 miles, and would impact approximately 796 acres of land. The rail line segment between Gold Creek and Curry is constrained by the Susitna River to the west and the Talkeetna Mountains to the east. Pipeline construction would be difficult in this area. The segment of the proposed Project route that would be replaced by the Curry Route Variation is 69.1 miles long, approximately 3.5 miles longer. However, 202 acres of lands outside of the existing Parks Highway ROW would be affected by this segment due to co-location with the highway. Therefore even though the Curry Route Variation would be 3.5 miles shorter, it would require new ROW impacts on 594 more acres of lands. The Curry Route Variation would cross approximately 64 streams as opposed to 39 stream crossings for the segment of the proposed Project route that it would replace. The Curry Route Variation would not be road accessible and would require access from the Parks Highway at the north or south ends, or from the ARR. Based upon this analysis, the Curry Route Variation would present construction and maintenance access issues and would not present environmental advantages over the proposed Project route.

Port MacKenzie Rail Route Variation

The Port MacKenzie Rail Route Variation would follow the ROW of the proposed Port MacKenzie Rail Extension Project (Figure 4.4-4). The total length of the route variation would be 33.1 miles. Approximately 11.3 miles would parallel the existing rail line and Parks Highway

[6] The proposed Project is identified as 'ASAP Mainline' on this figure.

from Willow to near Houston, and 21.8 miles would be located adjacent to the Port MacKenzie Rail Extension Project that would extend from near Houston to Point MacKenzie.

The segment of the proposed Project route that would be replaced by the Port MacKenzie Rail Route Variation would be 30.6 miles, would impact approximately 135.7 acres of wetlands within a 100-foot-wide construction ROW, and would cross 12 streams. The 21.8 mile segment of the Port MacKenzie Rail Route Variation extending from near Houston to Point MacKenzie would impact approximately 160 acres of wetlands within a 70 to 80-foot wide area to be occupied by the rail bed and adjacent access/service road, and would cross 25 streams (Surface Transportation Board 2011). Similar impacts would result from extending the width of the ROW to accommodate the proposed Project. Additional wetland impacts and stream crossings would occur within the 11.3 mile segment from Willow to near Houston. Based upon this comparison, co-location of the proposed Project pipeline with the Port MacKenzie Rail Extension Project would result in a 2.5-mile longer pipeline, more wetland impacts and a greater number of stream crossings than the segment of the proposed Project pipeline that would be replaced. Based upon this analysis, the Port MacKenzie Rail Route Variation would not present environmental advantages over the proposed Project route.

4.5 ABOVEGROUND FACILITY SITE ALTERNATIVES

Aboveground facilities that would be components of the proposed Project include: a North Slope GCF; a Fairbanks gas straddle and off-take facility; one or two compressor stations; a NGLEP facility; access roads; valves; pigging facilities; maintenance facilities; and pipe yards and camps. The general locations of these facilities are constrained by proximity, technical, and logistical issues related to proposed Project construction and operations. For example, the GCF would need to be near the gas source and pipeline; the NGLEP facility would need to be near the pipeline terminus; and compressor stations would need to be within defined increments of the pipeline to efficiently compress and transport the natural gas. Considering these constraints, the AGDC applied other siting criteria to determine the specific locations of the proposed aboveground facilities. These siting criteria included limiting impacts to: topography; waters, wetlands and habitats; visual resources; cultural resources; and people and communities. Considering the AGDC facility siting process and the facility location constraints related to proposed Project construction and operations, it is reasonable to assume that environmental impacts could be effectively reduced by employment of site specific mitigation measures and that alternative facility sites would not result in net environmental advantages. Mitigation measures proposed by the AGDC have been identified and evaluated in Section 5.23 of the Final EIS. Accordingly, specific alternative aboveground facility sites have not been identified.

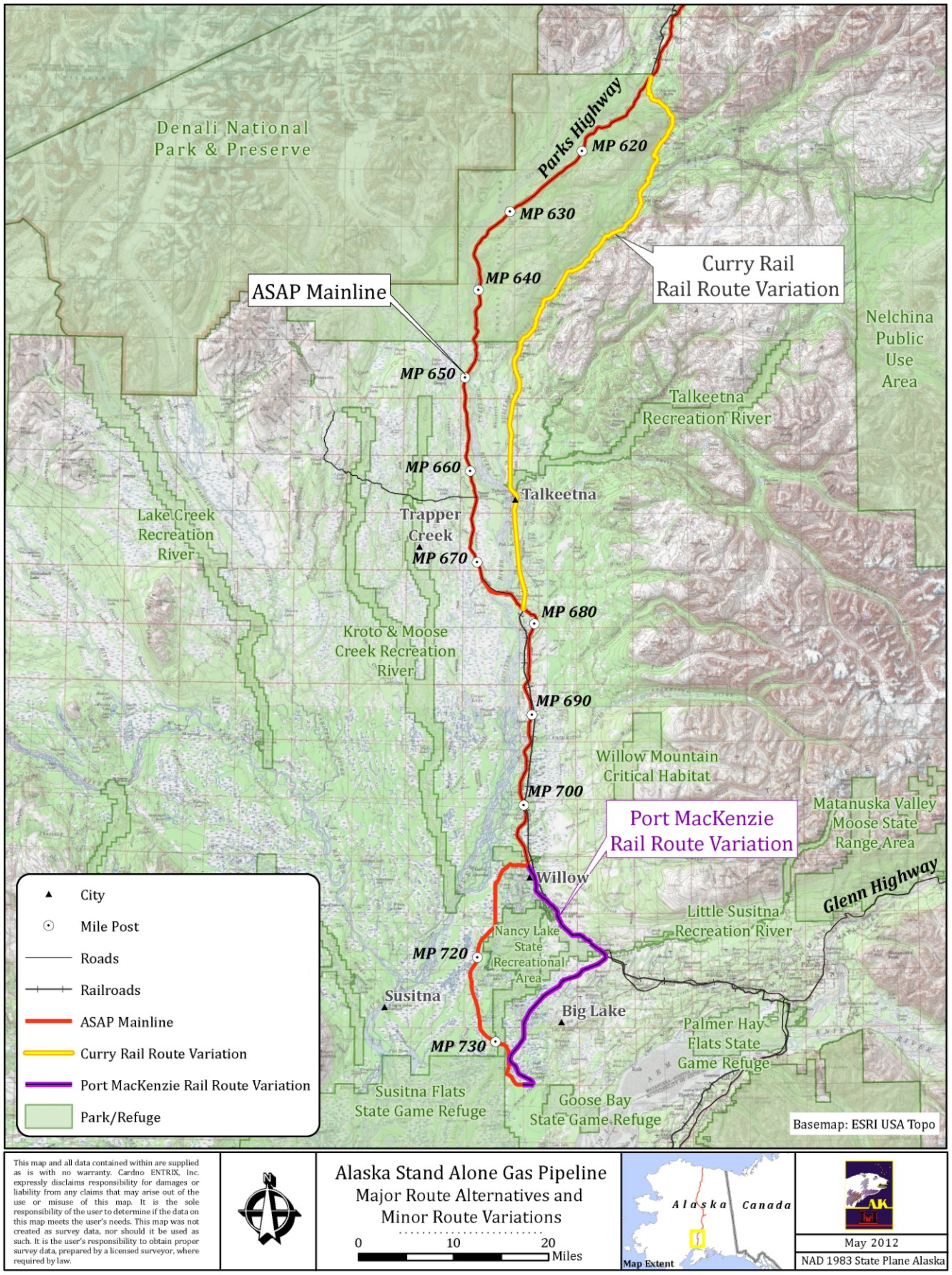

FIGURE 4.4-4 Curry Rail Route Variation and Pork MacKenzie Route Variation

4.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The alternatives analysis described in Section 4.2 through 4.5 indicate that the Denali National Park Route Variation should be carried forward for detailed analysis in Section 5, Environmental Analysis as a reasonable alternative that may have environmental advantages over the segment of the proposed Project route that it would replace. The other alternatives that have been identified do not meet the purpose and need objectives of the proposed Project, are not reasonable and/or do not include features that would lessen environmental impacts when compared to the proposed Project. Therefore, the other alternatives considered herein are not carried forward for detailed analysis in Section 5, Environmental Analysis. A summary of alternatives and their status is presented in Table 4.6-1.

TABLE 4.6-1 Summary of Alternatives and their Status

Type Alternative	Specific Alternative	Conclusion	Status
No Action	No Action Alternative	Analysis required by NEPA.	Analyzed herein and in Section 5 of this document.
Alternate Energy	Kenai Peninsula and Cook Inlet Natural Gas	New Kenai Peninsula and Cook Inlet natural gas reserves that could provide a long-term, stable supply of natural gas to markets in the Fairbanks and Cook Inlet areas remain unproven at this time.	Considered but eliminated from detailed analysis.
Alternate Energy	Gubik Field Natural Gas	Gubik Field remains a commercially unproven source of gas.	Considered but eliminated from detailed analysis.
Alternate Energy	Nenana Basin Field Natural Gas	The Nenana Basin remains an unproven source of gas.	Considered but eliminated from detailed analysis.
Alternate Energy	LNG Import	The economic benefits of utilizing an in-state gas source would not be realized.	Considered but eliminated from detailed analysis.
Alternate Energy	Hydro Power	Could reduce, but not replace, the existing and future need for natural gas within the proposed Project's timeframe (2019).	Considered but eliminated from detailed analysis.
Alternate Energy	Nuclear Power	Could reduce, but not replace, existing and future needs for natural gas within the proposed Project's timeframe (2019).	Considered but eliminated from detailed analysis.
Alternate Energy	Coal and coal gas	Could reduce, but not replace, existing and future needs for natural gas.	Considered but eliminated from detailed analysis.
Alternate Energy	Renewable Sources (Wind, Geothermal, Biomass, Tidal)	Could reduce, but not replace, existing and future needs for natural gas.	Considered but eliminated from detailed analysis.
Energy Conservation	Energy Conservation Measures and Programs	Enhanced programs could result in a reduction of the region's capacity and annual energy requirements, but not in sufficient quantities to meet future energy needs.	Considered but eliminated from detailed analysis.
Natural Gas Transport System	Dry Gas Pipeline from North Slope	Would not lessen environmental impacts when compared to the proposed pipeline. Would not transport NGLs.	Considered but eliminated from detailed analysis.
Natural Gas Transport System	Smaller Diameter Pipeline	Would not lessen environmental impacts when compared to the proposed Project	Considered but eliminated from detailed analysis.

TABLE 4.6-1 Summary of Alternatives and their Status

Type Alternative	Specific Alternative	Conclusion	Status
Natural Gas Transport System	Spur Pipeline From a Large North Slope-to-Lower 48 or Valdez Pipeline	Large pipeline is uncertain and would not likely be completed and transporting natural gas by 2019.	Considered but eliminated from detailed analysis.
Natural Gas Transport System	Pipeline from North Slope to Fairbanks, Transport by Rail Car to Southcentral Alaska	Not a logistically practicable or reasonable means of moving large volumes of natural gas from Fairbanks to Southcentral Alaska for 30 or more years.	Considered but eliminated from detailed analysis.
Natural Gas Transport System	Transport by Truck/Trailer	Not logistically viable or reasonable.	Considered but eliminated from detailed analysis.
Pipeline Route	Richardson Highway Route Alternative	Longer route does not include features that would lessen environmental impacts when compared to the proposed Project.	Considered but eliminated from detailed analysis.
Pipeline Route	Fairbanks Route Variation	Longer route does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered but eliminated from detailed analysis.
Pipeline Route	Alaska Intertie Route Variation	Route has access, engineering and constructability issues, and does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered but eliminated from detailed analysis.
Pipeline Route	Denali National Park Route Variation	A reasonable, constructible alternative that could minimize visual impacts in the area of Denali National Park[7].	Carried forward for detailed analysis in Section 5.
Pipeline Route	Curry Rail Route Variation	Route has access and constructability issues and does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered but eliminated from detailed analysis.
Pipeline Route	Port MacKenzie Rail Project Route Variation	Route does not include features that would lessen overall environmental impacts when compared to the proposed Project.	Considered but eliminated from detailed analysis.
Above Ground Facility Site	None identified	Project siting process to avoid environmentally sensitive areas suggests environmental impacts could be more effectively reduced by employment of site specific mitigation measures and that alternative facility sites would not result in net environmental advantages.	Considered but eliminated from detailed analysis.

4.7 REACHING A DECISION

The USACE initiated the NEPA process as part of a planning document for the proposed Project. The USACE will make a decision according to its NEPA implementation regulations once a complete application has been received, a public interest review has been completed, and following the CWA Section 404(b)(1) Guidelines. The following sections discuss the regulatory requirements and USACE approaches concerning NEPA's preferred alternatives; the CWA's least environmentally damaging practicable alternative or LEDPA; and the USACE's process for making its final permit decision.

[7] Federal legislation that would allow the route variation has been introduced by the Alaska delegation, and is currently being considered by the U.S. Congress.

4.7.1 Agency Preferred Alternative

NEPA guidance directs an agency to identify a preferred alternative in the Final EIS "… unless another law prohibits the expression of such a preference." (40 CFR 1502.14[e]). The USACE, in the establishment of their regulatory rules (51 FR 41220), clearly stated their neutrality in issuing permits by affirming that they are "neither a proponent nor opponent of any permit proposal." To maintain this neutrality, the USACE does not identify a preference within a draft or final EIS, but rather identifies the Applicant's proposal as the "Applicant's preferred alternative" in the final EIS (33 CFR 325, Appendix B). The USACE cannot take a position on a permit, and will thus not identify its selected alternative until after the public interest review and finding of conformity with the 404(b)(1) Guidelines, which will be summarized in the USACE's Record of Decision for the permit. Cooperating agencies have the option to identify separate agency-preferred alternatives in an EIS. Two of the cooperating agencies for the ASAP EIS have a regulatory decision to make in association with this NEPA process; therefore, they are stating their preferred alternatives in this Final EIS:

- The BLM's preferred alternative is the proposed action; and
- The State Pipeline Coordinator's Office on behalf of the State of Alaska supports the Applicant's proposed Project as the State's preferred alternative.

4.7.2 Environmentally Preferable Alternative

An environmentally preferable alternative is one that would best meet the goals set forth in Section 101 of NEPA (42 USC §4331). The environmentally preferable alternative generally would cause the least damage to the biological and physical environments and "best protects, preserves, and enhances historic, cultural, and natural resources." (50 FR 15618). The environmentally preferred alternative or other alternative could be the agency-preferred alternative, but may not be, due to considerations made by each agency based on their statutory mission. An environmentally preferable alternative is not identified in this Final EIS for USACE because it would be predecisional to the USACE's decision on the Applicant's permit application.

4.7.3 Least Environmentally Damaging Practicable Alternative

The 404(b)(1) Guidelines require the USACE to determine whether the Applicant's proposal is the LEDPA. To be practicable, an alternative must be available and capable of being done after consideration of cost, existing technology, and logistics in light of overall project purposes. Only the LEDPA can be permitted. Within this Final EIS, the USACE has analyzed the impacts of the proposed action, the no-action alternative, two additional Yukon River crossings variations, and a Denali National Park Route Variation. The Corps and cooperating agencies examined the full scope of possible alternatives and components and systematically arrived at the range of reasonable alternatives as described earlier in this chapter. Through this process, the Corps believes that it has captured all of the alternatives and components necessary to determine whether the Applicant's proposed project is the LEDPA, and ultimately make a permit decision. Additional detailed information contained in a complete application will be required to make this decision. The USACE has the option to deny the permit, issue the permit, or issue the permit with modification; see Appendix A for the Section 404(b)(1) Guideline Checklist.

4.7.4 USACE Decision Process

After the release of this Final EIS, the USACE will finalize its decision whether or not to issue a permit. The USACE decision will be documented in a Record of Decision (ROD) and will be based on information from this Final EIS, analysis of the proposed Project's compliance with the 404(b)(1) Guidelines, and the Public Interest Review.

4.7.4.1 Final EIS

The Final EIS discloses potential impacts associated with the Applicant's proposed Project and route variations. The USACE will consider the potential impacts disclosed in the Final EIS and associated mitigation to inform its permit decision. The alternatives and impact analysis in the Final EIS also provide a basis for determination of compliance with the 404(b)(1) Guidelines.

4.7.4.2 Compliance with 404(b)(1) Guidelines

Under Subpart B of the 404(b)(1) Guidelines, the USACE evaluation of the proposed Project will result in four compliance determinations that conclude in a finding of whether the proposed Project complies with the 404(b)(1) Guidelines. The first of these determinations results in the identification of the LEDPA. Key to this determination is that the USACE can only permit the LEDPA. The remaining determinations establish whether there would be any violations of other applicable laws, whether the discharge would cause or contribute to the degradation of waters of the U.S., and whether steps have been taken to minimize potential impacts. The Guidelines evaluation document builds on the alternatives and impact analysis developed within the EIS, with a focus on the specific decision-making framework required by the 404(b)(1) Guidelines.

4.7.4.3 Public Interest Review

The USACE will evaluate the Applicant's proposal against the public interest factors (33 CFR 320.4[a]). The importance of each factor and how much weight it is given are unique to each proposal. The USACE establishes the weight of each factor by its relevance to the proposal. The weighing of these factors allows the USACE to determine whether or not the proposed Project is contrary to the public interest. In addition to the evaluation of the public interest factors, the USACE must also consider the extent of the public/private need for the proposal, the practicability of using reasonable alternative locations and methods if there are unresolved conflicts as to resource use, and the extent and permanence of the beneficial and/or detrimental effects of the proposal. The ROD will state if the permit is denied or granted, based on the findings of the three, above-mentioned processes. If the decision is to not issue a permit, the filling of wetlands would not be allowed. If the decision is to issue a permit, the permit would describe the Project, conditions, and mitigation required. The Applicant will be given the opportunity to review the permit and conditions, should the decision be to issue a permit, and decide whether to accept all terms and conditions therein or appeal the decision. If a permit is issued, the Applicant would also finalize required permitting processes with the State of Alaska and the North Slope Borough.

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5.0 ENVIRONMENTAL ANALYSIS

The environmental analysis of the proposed Project and alternatives describes: the affected environment; direct, indirect and cumulative impacts that would result from construction and operations; and mitigation measures that could reduce impacts to each affected resource. The environmental analysis is organized by physical, biological and human environmental resources in Sections 5.1 through 5.22.

Sections 5.1 through 5.22 discuss the affected environment, construction and operations impacts, and measures to mitigate impacts to affected resources. The environmental consequences of constructing and operating the proposed Project would vary in context, intensity and duration. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts would generally occur during construction, with the resources returning to pre-construction conditions almost immediately afterward. Short-term impacts would continue for approximately 3 years following construction. Impacts were considered long term if the resources would require more than 3 years to recover. Permanent impacts would occur as a result of activities that modify resources to the extent that they would not return to pre-construction conditions during the life of the proposed Project, such as with construction of aboveground structures. Impacts that would result in change in the environment are quantified and described qualitatively.

The proposed Project would incorporate measures to reduce environmental impacts as described in Section 5.23. The AGDC would incorporate mitigation measures required in authorizations and permits issued by environmental permitting agencies into the construction, operation, and maintenance of the proposed Project.

5.1 SOILS AND GEOLOGY

This section describes the soils and geology encountered in the proposed Project area. Soils are defined by the Soil Science Society of America (2011) as "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro and microorganisms, conditioned by relief, acting on parent material over a period of time." Since the proposed Project route traverses a wide variety of terrain types and permafrost characteristics, land features are presented in the context of ecoregions. Ecoregions are defined as ecologically distinct areas based on climate, terrain, soils, and vegetation.

In addition, several geomorphic processes and features are encountered in the proposed Project area, including mass wasting, permafrost degradation/aggradation and frost action, and seismicity. Paleontological resources are also present. Permafrost is defined by Alaska Division of Geological and Geophyisical Surveys (DGGS 2011) as any soil, subsoil, or other surficial deposit, or even bedrock, occurring in the arctic, subarctic, and alpine regions at variable depth beneath the Earth's surface in which a temperature below freezing has existed continuously for a long time (from two years to tens of thousands of years) where seasonally frozen ground freezes and thaws annually, and when it is a layer over permafrost, it is called the active zone.

The State of Alaska does not contain prime farmland, prime forest land, or prime rangeland soils. In addition, no soils designated as unique farmlands or farmlands of statewide importance have been designated in Alaska.

5.1.1 Affected Environment

5.1.1.1 Ecoregions

Ecoregions represent a rigorous interagency and multidisciplinary approach to mapping and managing Alaska's natural resources at the landscape level. The development of ecoregions required a cooperative consensus between the United States Forest Service (USFS), National Park Service (NPS), United States Geological Survey (USGS), The Nature Conservancy, and many other agencies and private organizations. Ecoregion units are delineated along gradients of climate, vegetation and disturbance processes (Gallant et al. 1995). Out of the 32 ecoregions that exist in the state, nine are traversed by the proposed Project (Figure 5.1-1).

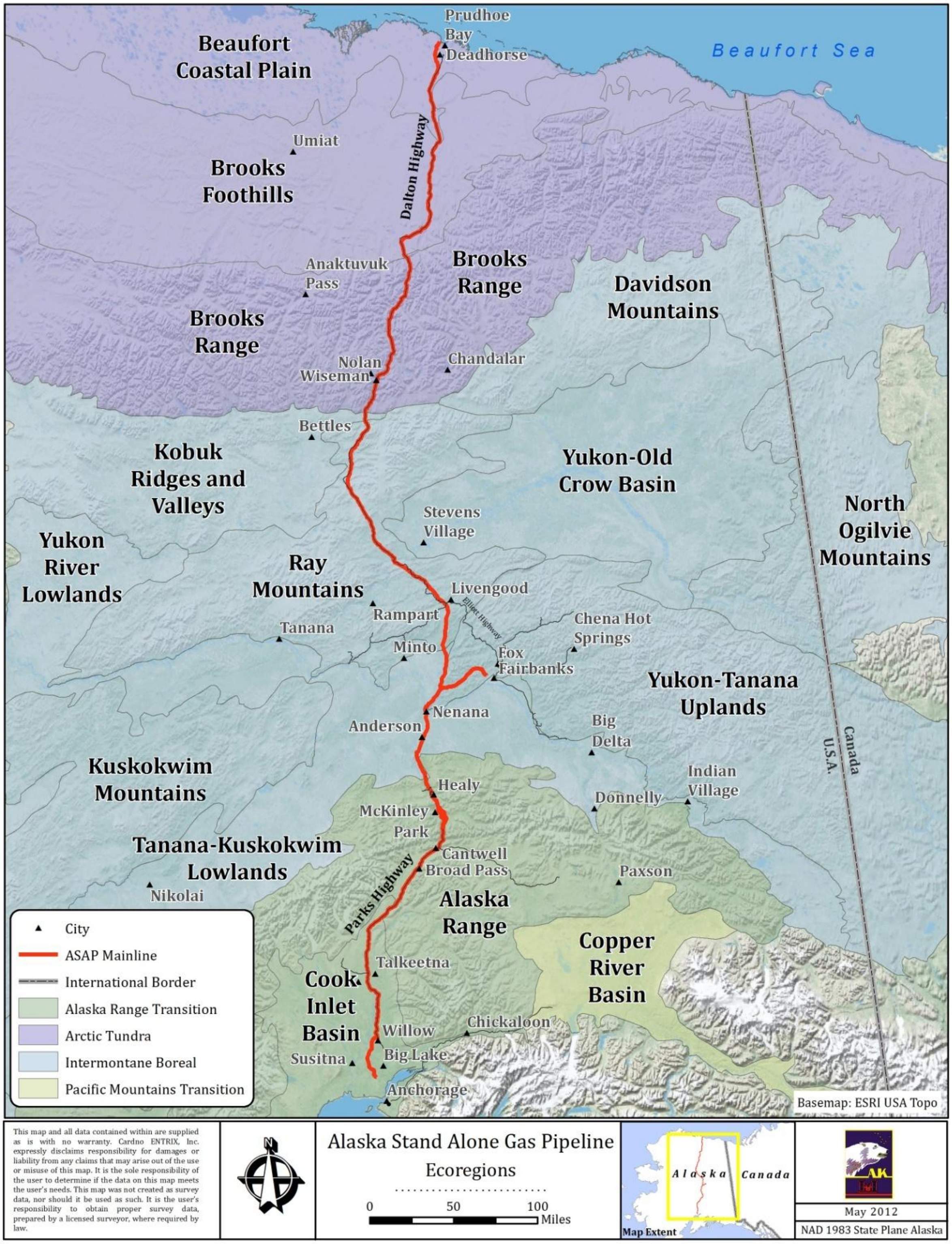


FIGURE 5.1-1 Alaska Stand Alone Gas Pipeline Ecoregions

There are eight ecoregions crossed by the proposed Project from the Gas Conditioning Facility (GCF) in Deadhorse to MP 540 near Denali National Park and Preserve (NPP), which is in the Alaska Range Ecoregion. From MP 540, the route continues through the Alaska Range Ecoregion and then crosses the Cook Inlet Basin Ecoregion to the terminus of the pipeline in Beluga. There are three route variations proposed to cross the Yukon River which are located entirely within the Ray Mountains ecoregion, the two route variations near Denali NPP are located within the Alaska Range ecoregion, and the Fairbanks Lateral is located entirely within the Yukon-Tanana Uplands ecoregion (Table 5.1-1).

Each ecoregion traversed by the proposed Project is described in the following sections, presented from north to south: Beaufort Sea Coastal Plain Ecoregion, Brooks Foothills Ecoregion, Brooks Range Ecoregion, Kobuk Ridges and Valleys Ecoregion, Ray Mountains Ecoregion, Yukon-Tanana Uplands Ecoregion, Tanana-Kuskokwim Lowlands Ecoregion, Alaska Range Ecoregion, and Cook Inlet Basin Ecoregion.

TABLE 5.1-1 Ecoregions of the Proposed Project

Ecoregion[a]	Segment Name and Location									
	MP 0 to MP 540		MP 540 to MP 555		Denali National Park Variation		MP 555 to End		Fairbank Lateral	
	GCF to Denali NPP		Around Denali NPP		Through Denali NPP		Denali NPP to Beluga		Dunbar to Fairbanks	
	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent	Miles[b]	Percent
Beaufort Coastal Plain	63.6	11.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brooks Foothills	83.7	15.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brooks Range	108.5	20.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kobuk Ridges and Valleys	5.05	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ray Mountains	171.3	31.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Yukon-Tanana Uplands	14.7	2.7	N/A	N/A	N/A	N/A	N/A	N/A	34.4	100
Tanana-Kuskokwim Lowlands	72.0	13.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Alaska Range	20.1	3.7	15	100	15.3	100	61.2	33.7	N/A	N/A
Cook Inlet Basin	N/A	N/A	N/A	N/A	N/A	N/A	120.2	66.3	N/A	N/A
Totals	**539**	**100**	**15**	**100**	**15.3**	**100**	**181.4**	**100**	**34.4**	**100**

Key:
a – Ecoregions of Alaska (Nowacki et al. 2001).
b – Alignments provided by Alaska Gasline Development Corporation.
GCF – Gas Conditioning Facility
NP – National Park
N/A – not applicable

Beaufort Coastal Plain Ecoregion

The Beaufort Coastal Plain Ecoregion features smooth, planar topography, rising gradually for 60 miles north to south to an elevation of approximately 600 feet (Wahrhaftig 1965). The Beaufort Sea Coastal Plain Ecoregion is characterized by a network of polygonal ground features, forming shallow troughs at the borders, and oriented thaw lakes formed by permafrost processes. Locally, pingos (mounds of earth-covered ice) form in flat, low-lying, drained or sediment-filled ponds (BLM and ANHA 1993, French 2007). The polygonal ground features are generally comprised of marine, fluvial, eolian, and lacustrine sediments of Quaternary age (Kreig and Reger 1982). The coastal plain is mantled with Quaternary deposits of alluvial, glacial, and aeolian origin. Siltstone and sandstone lie beneath the unconsolidated materials at varying depths ranging from 10 to more than 30 feet (Gallant 1995). The proposed Project would not cross any known active faults within this ecoregion.

Throughout most of the proposed Project area in this ecoregion, the floodplain of the Sagavanirktok River grades from a braided river system to a meandering channel flowing north toward the Beaufort Sea. The braided nature of the river channels reflects the unconsolidated nature of the bedrock, the availability of abundant bedload, and the highly seasonal discharge regime. During summer, the gradual melt of snowbanks on east-facing slopes provides moisture for mass wasting (solifluction) to occur (French 2007), although the solifluction process can be active on slopes of any aspect. Locally, channels may be floored with sandy silts that represent former, seasonal floodplain deposits overlying sand and gravel (Kreig and Reger 1982). Sheet ice from successive stream bank overflows is present on various sections of the floodplain during winter (APSC 2007) and can persist into the summer in many areas.

The dominant soils of the Beaufort Coastal Plain consist of several feet of ice-rich organic silt overlaying coarse sands and gravels (APSC 2007). Massive ground ice is widespread throughout the area, appearing as vertical wedges, films, lenses, pore-fillings, and segregated masses. Networks of ice wedges create polygonal ground features on the surface.

The Beaufort Coastal Plain Ecoregion is underlain by thick, continuous permafrost, with an average temperature of less than 19°F (Brown et al. 1997, Ferrians 1965). The permafrost is 670- to 2,150-feet thick in most areas (Péwé 1975). Polygonal ground features, formed by ground contraction and ice wedge formation and oriented lakes, formed by the thawing of ice-rich soils, characterize low-lying areas. Shallow thaw bulbs may be present beneath active river channels and lakes at depths greater than 6 feet (Kreig and Reger 1982).

Brooks Foothills Ecoregion

The Brooks Foothills Ecoregion features glacial moraines composed primarily of coarse-grained till covered with loess, extensive glacial outwash deposits and low-elevation bedrock landforms, generally rising to a few hundred feet in elevation and comprised primarily of sandstone, siltstone, and shale of Cretaceous age (Table 5.1-2) (BLM and ANHA 1993). The proposed Project area in this ecoregion is drained primarily by the north-flowing Sagavanirktok River, which is characterized by a braided river system grading to a meandering channel flowing north toward the Beaufort Coastal Plain. Sedimentary outcrops of Cretaceous age are exposed to form elevated bluffs along the flanks of the river. Tilted, laminar sandstones, siltstones, and shales of Cretaceous age are also exposed in scattered outcrops throughout the Brooks Foothills (e.g., Slope Mountain) (BLM and ANHA 1993). The proposed Project would not cross any known active faults within this ecoregion.

TABLE 5.1-2 Geologic Timeline

EON	ERA	PERIOD	MILLIONS OF YEARS AGO
Phanerozoic	Cenozoic	Quaternary	1.6
		Tertiary	66
	Mesozoic	Cretaceous	138
		Jurassic	205
		Triassic	240
	Paleozoic	Permian	290
		Pennsylvanian	330
		Mississippian	360
		Devonian	410
		Silurian	435
		Ordovician	500
		Cambrian	570
Proterozoic	Late Proterozoic Middle Proterozoic Early Proterozoic		2500
Archean	Late Archean Middle Archean Early Archean		3800?
Pre-Archean			

Source: USGS 1997

Planar upland depressions are partially filled with ice-rich peat and organic-rich slope wash deposits. Colluvium may partially fill thaw ponds and basins. The Brooks Foothills are underlain by continuous permafrost, with an average temperature of less than 19°F (Brown et al. 1997). Although exact thickness of the permafrost is uncertain, records from other parts of the northern Brooks Range and Arctic Foothills (for example, Ferrians 1965) suggest that its base probably occurs between 490–820 feet in depth (Hamilton 2003). Massive ground ice, up to 50 percent by volume (Kreig and Reger 1982), is common in the tills of this region. Near-surface permafrost promotes solifluction, the slow flowage of soil within the active layer during the annual thaw season. Solifluction and gelifluction are widespread in the Brooks Foothills Ecoregion. Gelifluction is defined by the DGGS (2011) as progressive lateral flow of earth material in an area which is subject to intense freezing cycles and exhibits permafrost weathering and erosion characteristics. Solifluction is most active during spring and early summer when the active layer generally is saturated with moisture released by thawing that remains confined above the surface of impermeable permafrost. Movement rates up to 2 inches per year are common, but more rapid rates up to 4 or even 6 inches per year have been recorded on some solifluction slopes (Hamilton 2003). Permafrost free zones or thaw bulbs (taliks) are likely to occur only beneath water bodies with depths greater than 6 feet (French 2007). In the floodplain of the Sagavanirktok River continuous permafrost is present adjacent to the active channel.

River and stream icings, a phenomenon also called aufeis, may occur during freeze-up and in winter. Stream icings are attributed either to a reduction in the cross-sectional area of an ice covered channel as freezing advances, or to an increase in snow load on an initial ice cover thus raising the hydrostatic head beneath the ice to an elevation higher than the ice surface. If water cannot escape from the banks due to the freezing of the active layer, fractures in the ice can allow water to escape over the ice cover, freezing as an icing. In shallow braided streams, small icing mounds, 3- to 10-feet high, may develop in response to localized restrictions of flow by ice freezing to the bed of the braid bars (French 2007).

Brooks Range Ecoregion

The Brooks Range Ecoregion is comprised of rugged, glaciated, east-west trending mountains rising from the Brooks Foothills to elevations ranging from 4,000 to 8,000 feet (Wahrhaftig 1965). Erosional landforms associated with alpine glaciers, such as cirques and U-shaped valleys, are common throughout the Brooks Range. Talus slopes, alluvial fans, moraines, and outwash fans are well developed at the bases of valleys and cirques. Drainages in the north Brooks Range discharge through the Sagavanirktok River to the Arctic Ocean; drainages in the south discharge to the Bering Sea via the Atigun and Dietrich Rivers. Most of the major drainages flow to discharge locations within U-shaped valleys, scoured by Pleistocene glaciations (APSC 2007).

Bedrock in the Brooks Range includes folded and thrusted Paleozoic and Mesozoic sedimentary rocks (exposed in the northern flank of the range), deformed Paleozoic metamorphic rocks (in the central Brooks Range), and Late Proterozoic to Paleozoic metamorphic rocks (in the southern Brooks Range) (Moore et al. 1994). Surficial deposits of the Brooks Range are modern stream alluvium and Pleistocene age and younger fluvial, lacustrine, colluvial, glacial, and glaciofluvial sediments (Hamilton 2003). The proposed Project would not cross any known active faults within this ecoregion.

Coarse-grained sands and gravels underlie the Atigun River and Dietrich River valleys within the proposed Project area of the Brooks Range. Windblown silts and sands are present in the Atigun River floodplain (Kreig and Reger 1982). Near the toes of steep-sloped alluvial fans, moraines, talus, and unsorted, coarse to very-coarse sediments are common. In previously scoured glacial basins (e.g., Galbraith Lake), lacustrine silt and clay may overlie coarse-grained glaciofluvial and glacial deposits.

The Brooks Range is underlain predominantly by continuous permafrost that has an average temperature of 19°F to 27°F (Brown et al. 1997). Ground ice contents vary from up to 15 percent ice in fluvial silts and sands, to 25 to 95 percent ice in lacustrine silts and clays near

Galbraith Lake. In river valleys, vegetated areas of moraine, fan, and alluvial deposits are continuously frozen from the base of the active layer to more than 50 feet below ground surface in the northern Brooks Range (Kreig and Reger 1982). Permafrost depth is greater in coarse grained deposits than in fine grained deposits and trends from north (deeper) to south (shallower). Due to seasonal variations and the heat from water within river channels, permafrost can be discontinuous within the alluvium underlying major active rivers (Ferrians 1965, Kreig and Reger 1982).

Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valleys Ecoregion consists of low ridges and lowlands south of the Brooks Range (Wahrhaftig 1965). The proposed Project area follows the floodplain of the Middle Fork Koyukuk River These lowlands are underlain by unconsolidated Quaternary sediments. Late Paleozoic and Mesozoic igneous rocks (both extrusive and intrusive) are exposed at the surface of ridges (BLM and ANHA 1993). Very little is known about the seismic potential of the Kobuk fault, a Cenozoic strike-slip fault approximately 40 miles away from the proposed Project area, on the southern flank of the Brooks Range (Freymueller et al. 2008). The proposed Project would not cross any known active faults within this ecoregion (Figure 5.1-2). The soils of Kobuk Ridges and Valleys are a product of Pleistocene glaciations. Coarse-grained glacial and glaciofluvial sediments are distributed near the main channels of the Middle and South Fork Koyukuk rivers. Away from the channels, soils consist of fine-grained silt and clay of eolian and lacustrine origins that overlie coarse-grained glacial tills (Hamilton 1994). Thaw lakes are well developed in the silt of the lowlands between the Middle and South Fork Koyukuk rivers.

This ecoregion is underlain by discontinuous permafrost with an average temperature of 27°F to 30°F (Brown et al. 1997). The proposed Project area runs through only five miles of the Kobuk Ridges and Valleys Ecoregion and is most likely within a continuous permafrost zone. Permafrost is generally absent beneath unvegetated floodplains within the region. Vegetated floodplains can overlie permafrost between 5- and 50-feet thick in local areas (Kreig and Reger 1982).

Ray Mountains Ecoregion

The Ray Mountains Ecoregion consists of rounded hills rising from 2,000 to 4,000 feet and extending to the Hess River, marking the location of the Rampart Trough (described below) (Wahrhaftig 1965). The Ray Mountains supported glaciers in the Pleistocene but are now largely unglaciated and commonly covered with colluvial and eolian deposits. Lower elevations are covered with retransported eolian deposits. The northern portions of the Ray Mountains are composed primarily of Proterozoic through Paleozoic age metamorphic rock, with some igneous intrusions of Cretaceous age present (BLM and ANHA 1993). The southern portion of the Ray Mountains consists predominantly of fine-grained, massive volcanics, and thinly interbedded cherts of Late Paleozoic to Middle Mesozoic ages. Bedrock in the uplands is primarily metamorphic rock of Paleozoic age (Foster et al. 1994). The proposed Project would not cross any known active faults in this ecoregion (Figure 5.1-2). The Kaltag and Tintina Faults project through the region; however, the location and kinematic connection between these faults is poorly defined. Both faults are thought to be active and even though the proposed alignment does not cross these structures, they could generate strong ground motion.

The Rampart Trough, near the Hess River, is a narrow depression created by erosional processes along a tightly-folded belt of soft, coal-bearing rocks of Tertiary age. Topographically, the Rampart Trough is 500 to 2,500 feet below the surrounding upland terrain (Wahrhaftig 1965) and has been seismically active. The Rampart seismic zone is situated between the Kaltag fault and Tintina fault system, northwest of Fairbanks. This area was the location of a magnitude 5.0 earthquake in 2003 about 15 miles south-south east of the Village of Rampart and was felt strongly by residents throughout the area. The largest recorded earthquake in the Rampart seismic zone was a magnitude 6.8 that occurred in 1968. Northeast of the Rampart seismic zone is a cluster of earthquake activity known as the Dall City seismic zone. Little is known about this seismic zone that generated a magnitude 5.2 in 1969, as well as 5 earthquakes greater than magnitude 5.0 in 1985, the largest of which was a magnitude 6.1 (AEIC 2011).

South of the Rampart Trough, to the Tanana River, the Yukon-Tanana Uplands are characterized by rounded hills with gentle-sided slopes. The hills, at elevations of 1,500 to 3,000 feet, rise 500 to 1,500 feet in elevation above the adjacent valleys. The valleys are generally a quarter to half-mile wide and contain alluvium (APSC 2007). The Yukon and Koyukuk Rivers and their tributaries are the major drainage systems of the Ray Mountains.

Most streams in this area are tributaries of the Yukon and the Tanana rivers (Wahrhaftig 1965). Streams flow either northeast to the Yukon River or southeast to the Tanana River. These two rivers transport silt that is redeposited on the top of the hills by eolian processes in the region. Several major lowlands are drained by the Yukon River and Hess Creek. These river valleys contain extensive Quaternary fluvial and eolian deposits (APSC 2007).

The soils of the Ray Mountains depend, in part, on their distance from the Tanana and Yukon rivers. In areas farther from the rivers, residual soils from weathered bedrock are dominant on hilltops and are generally a few feet thick. In valley bottoms, soils can be more than 40-feet thick, and are a combination of colluvium, fluvial sand and gravel, and weathered bedrock (Kreig and Reger 1982). Loess is common on the Ray Mountains near the Tanana and Yukon rivers. Silt is transported from river floodplains and deposited over coarse-textured subsoils.

Colluvium deposits, mostly composed of coarse-grained rock debris and retransported silt from the hills, are transported by mass wasting, and dominate lower hillsides away from the river valleys. Colluvium is estimated to be one to 18-feet thick at these locations. In the lowlands between the hills, silty colluvium is incorporated with organic matter (Péwé 1975, Péwé and Reger 1983).

Areas south of the Yukon River are underlain with discontinuous permafrost, with an average temperature of 27°F to 30°F (Brown et al. 1997) that generally decrease in depth from north to south. Frozen ground may be absent near major stream channels (Ferrians 1965). However, permafrost may be present in areas where a river channel has migrated, as permafrost can aggrade due to the absence of heat from the water that previously occupied the channel. Near the Yukon and the Tanana rivers, thick loess deposits on the uplands can contain ice as thick as 55 feet (Kreig and Reger 1982). Lowlands, where retransported silts accumulate, may have thicker ice-rich soils. In uplands, where loess is thin or absent, the ice content of colluvium or weathered bedrock is substantially lower. The soils in valley bottoms, surrounding rounded hills, are ice-rich and more than 50-feet deep in many locations (Kreig and Reger 1982). Thermokarst lakes are common in valley bottoms throughout the region.

Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands Ecoregion consists of rounded hills with gentle side slopes. The hills, at elevations of 1,500 to 3,000 feet, rise 500 to 1,500 feet above adjacent valleys. The valleys are generally a quarter to a half-mile wide and contain alluvium (Wahrhaftig 1965). They flow either northeast to the Yukon River or southeast to the Tanana River. The two rivers supply the silt (left behind from glacial retreat) that is deposited on the top of the hills by eolian processes. The bedrock in the uplands contains metamorphic rocks of Paleozoic age (Foster et al. 1994). Several major lowlands are drained by the Yukon, Tolovana, Tatalina, Chatnika, Chena, and Salcha Rivers in this ecoregion and by Hess Creek in the Ray Mountains Ecoregion. These river valleys contain extensive Quaternary fluvial and eolian sediments (APSC 2007).

The soil types on the uplands in part depend on the distance from the Yukon and Tanana rivers. In areas far from the rivers, residual soils from weathering bedrock are dominant on hilltops and are generally a few feet thick. In valley bottoms, soils can be more than 40-feet thick. The soils here are a combination of colluvium, fluvial sand and gravel, and weathered bedrock (Kreig and Reger 1982). The proposed Project would not cross any known faults within this ecoregion (Figure 5.1-2); however, two seismic belts that generally trend north-northeast are present in this area. The Fairbanks seismic zone was the site of three magnitude 5.5 to 5.9 earthquakes in 1967. The Salacha seismic zone is south of the Fairbanks seismic zone, and was the location of a 7.3 magnitude earthquake in 1937 (AEIC 2011).

This ecoregion is underlain by discontinuous permafrost with a temperature of 27°F to 30°F (Brown et al. 1997). Permafrost depth generally decreases from north to south. Near the main channels of major streams, frozen ground may be absent (Ferrians 1965). However, as a stream channel migrates, permafrost can redevelop due to the ground refreezes in the absence of the heat of water that once occupied the channel. Near the Yukon and Tanana rivers, the thick windblown silt on the uplands can contain ice upwards of 55-feet thick (Kreig and Reger 1982). The lowlands between the uplands where retransported silts accumulate may have even thicker ice-rich soils.

Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands Ecoregion comprises a broad geographic depression between the Ray Mountains to the north and the Alaska Range to the south. Adjoining outwash fans from the Alaska Range are present in the lowlands. Near the heads of these fans, rivers flow through broad terraced valleys that can be up to several hundred feet deep. Glacial moraines are present on the upper elevations of some alluvial fans (Wahrhaftig 1965). Windblown silt and sand dominate the surface material in the Tanana-Kuskokwim Lowlands, originating from the braided floodplains and outwash plains of the major rivers in the region. The central and eastern parts of this ecoregion are drained by the Tanana River. Coarse-grained sand and gravel are common near the active channels of major rivers (Péwé 1975, Kreig and Reger 1982). The proposed Project would not cross any known faults within this ecoregion (Figure 5.1-2). However, the proposed Project would cross the Minto Flats seismic zone, which runs about 100 miles from the Alaska Range northeast of Denali National Park to near Livengood. The north end of the Minto Flats seismic zone was the locality of a magnitude 6.0 earthquake in 1995 (Freymueller et al. 2008).

The lowlands and terraces have shallow and discontinuous permafrost, with an average temperature of 27°F to 30°F (Brown et al. 1997). The permafrost can be more than 50-feet thick in areas, but is absent under rivers. Isolated masses of permafrost are present in areas with coarse-grained sediments (Ferrians 1965, Kreig and Reger 1982). Thermokarst lakes are well developed on the terraces and low-lying areas away from the heads of the alluvial fans.

Alaska Range Ecoregion

The Alaska Range Ecoregion is comprised of a belt of flat-topped, east-trending hills (Wahrhaftig 1965), separated by lowlands composed of moraines and outwash plains of Pleistocene glacial origin. The Alaska Range proper is characterized as rugged glaciated terrain, 6,000 to 9,000 feet in elevation. Slope gradients, which are almost always greater than 5 degrees on hillslopes, exceed 25 degrees on some mountains. Gelifluction features are well developed and landslides and avalanches frequently sweep the steep, scree-lined slopes (Gallant et al. 1995). Glacial landforms and rock glaciers are common, including cirques, U-shaped valleys, moraines, outwash fans, and alluvial fans. Alaska Range drainages north of Broad Pass discharge into the Nenana River, which flows north through Windy Pass to the Tanana River. Locally, fine-grained loess covers outwash deposits in the lowlands (Wahrhaftig 1965). Most of the range drains into the Tanana River. Streams are swift and braided, and most rivers head in glaciers (Wahrhaftig 1965). The Alaska Range spans several faults, including the Denali Fault, Healy Creek Fault, Parks Road Fault, and the Northern Foothills Fold and Thrust Belt (Bemis 2010, Figure 5.1-2). Metamorphic rocks are exposed north of the Denali Fault and late Paleozoic marine sedimentary and volcaniclastic rocks are exposed to the south (APSC 2007).

Permafrost is discontinuous in the Alaska Range, with an average temperature of 30°F to 32°F (Brown et al. 1997). Ice-rich permafrost and thermokarst lakes develop in the lowlands, where loess is deposited. Permafrost is generally absent on south-facing slopes.

Cook Inlet Basin Ecoregion

The Cook Inlet Basin Ecoregion is bound to the north and west by the Alaska Range and to the east by the Talkeetna Mountains. Elevations range from sea level to 2,000 feet. The Cook Inlet

Basin Ecoregion surface deposits are primarily composed of poorly-sorted glacial moraines, tills, lake clays and peats, which gradually change to fine-grained, stratified proglacial deposits toward the south. Relatively flat, rolling topography, swampy terrain, and prominent outwash deposits represent the common landscapes seen in the Cook Inlet Basin Ecoregion. Bedrock consists primarily of Tertiary age coal-bearing sedimentary formations. The southeast portion of Cook Inlet Basin Ecoregion contains poorly-sorted tills and silty gravels, along with fluvial deposits from the Susitna River and its associated drainages (Wahrhaftig 1965).

Soils of the Cook Inlet Basin Ecoregion typically consist of peats and bogs in low lying areas that are flanked by morainal deposits, till, and outwash landforms. Permafrost, ranging from discontinuous in the north to absent in the south, varies throughout the Cook Inlet Basin Ecoregion. Isolated ice lenses may exist below peat-covered bogs. At its southern extent, permafrost exists only in isolated lenses as relic ice beneath thick peat bogs. Permafrost is unlikely near Cook Inlet (Gallant et al. 1995).

The Castle Mountain Fault is the only known active fault in the Cook Inlet Basin Ecoregion with an identified surface rupture. The fault lies along the southern margin of the Talkeetna Mountains. Both the 62-mile long eastern and 39-mile long western portions of the fault are seismically active (Figure 5.1-2). The eastern portion of the fault produced light to moderate magnitude 5.7 and 4.6 earthquakes in 1983 and 1996, respectively. The most recent significant earthquake along the western portion of the fault was about 650 years ago, which suggests the possibility a significant earthquake (~magnitude 6.0) may be expected in the near future (Freymueller et al. 2008, Hauessler et al. 2002, Haeussler et al. 2000).

5.1.1.2 Geomorphic Processes

Several geomorphic processes and features are encountered in the proposed Project area. Mass wasting, permafrost degradation/aggradation and frost action, seismicity, glacial and fluvial processes are described in the following sections. Geomorphic processes such as these must be considered in pipeline engineering, design, siting and construction due to the fact that these processes have the potential to impact pipeline stability and operations.

Mass Wasting

Mass wasting is a general term used to describe geologic processes that are primarily driven by the action of gravity on either consolidated or unconsolidated material. These processes include avalanches, rock falls, slides, and slumps, as well as solifluction in cold regions. Where freezing and thawing of moisture-rich soil is very active, frost propagation can fracture rocks. Depending on the water, ice, and snow content, as well as slope angle, transport processes may include frost creep, rockfalls or slides, solifluction, and slopewash (Davis 2000). These processes produce depositional landforms such as talus at the bases of fans and valley bottoms.

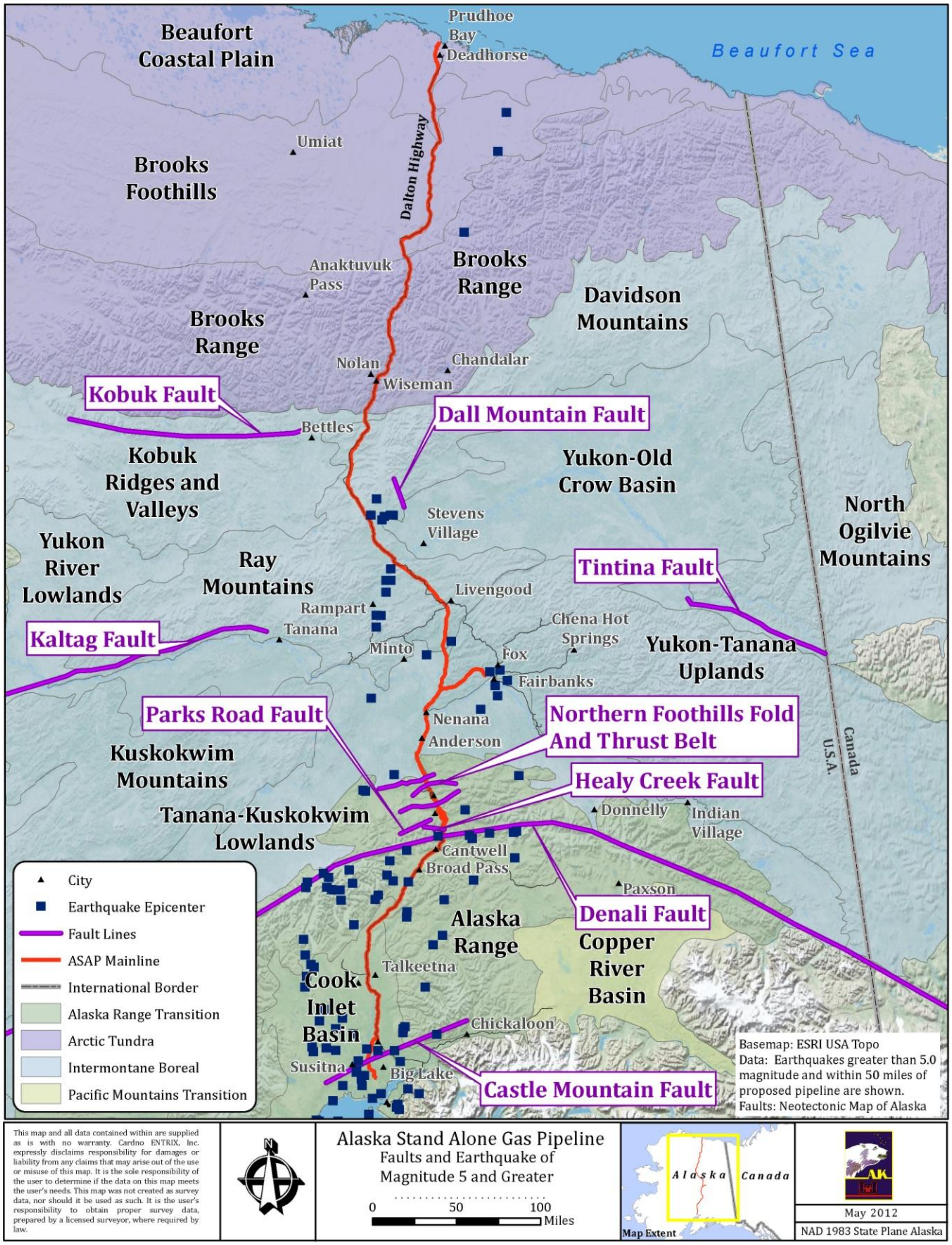


FIGURE 5.1-2 Alaska Stand Alone Gas Pipeline Earthquakes & Faults

Permafrost and Soil Processes

Permafrost can occur in both soils and bedrock, and is encountered in all ecoregions traversed by the proposed Project. Generally, the ice content in the soil or bedrock is related to the porosity and the moisture content of the material before it is frozen. However, moisture migration during freezing can create massive ice formations. Higher ice content generally occurs in fine-grained soils than in coarse-grained soils. The latter, in turn, has more ice content than fractured bedrock. Although permafrost and ice content are not synonymous, many important engineering challenges in dealing with permafrost are related, directly or indirectly, to the water, and/or ice content of permafrost. Moisture in the form of ice may or may not be present in permafrost (French 2007). Permafrost is defined by DGGS (2011) as any soil, subsoil, or other surficial deposit, or even bedrock, occurring in the arctic, subarctic, and alpine regions at variable depth beneath the Earth's surface in which a temperature below freezing has existed continuously for a long time (from two years to tens of thousands of years). On the basis of its extent, permafrost is classified as continuous (covering from 90 to 100 percent of an area), discontinuous (50 to 90 percent coverage), sporadic (10 to 50 percent coverage), or isolated patches (up to 10 percent coverage) (Brown et al. 1997). For the proposed Project, permafrost is classified as continuous from approximately MP 0-262, discontinuous from approximately MP 262-628, and absent from approximately MP 628- 736 (Brown et al. 2001). The depth of the active seasonal freeze-thaw layer in the proposed Project area ranges from 1 foot to about 15 feet.

Permafrost stability can be disrupted naturally by climate change, forest fires or drainage of lakes or artificially by human-impacted means. Permafrost degradation occurs as a result of progressive warming of ice-laden soils resulting in the thawing of near-surface permafrost and lowering of the permafrost table. Permafrost aggradation is the result of cooling soil temperatures and the propagation of permafrost. Both degradation and aggradation can be triggered by natural or artificial influences.

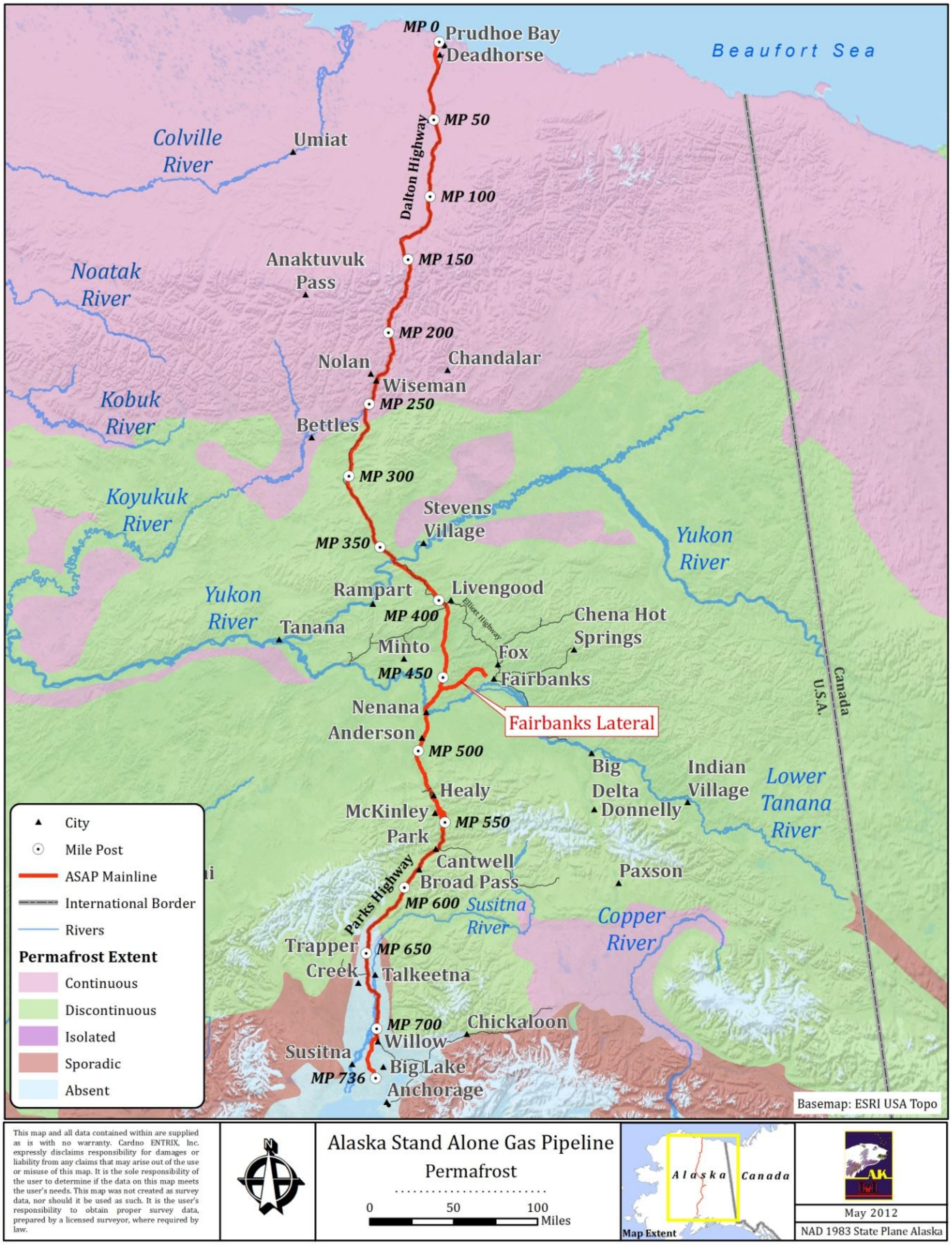
Liquefaction, a geomorphic process closely related to water content in soils, is also a condition that may be encountered in the proposed Project area. The DGGS (2011) defines liquefaction as the transformation of saturated, cohesionless soil from a solid to a liquid state as a result of increased pore pressure and reduced effective stress (in response to severe ground shaking resulting from an earthquake).

Frost heaving commonly occurs in silt-rich soils (common in areas that have been glaciated). Frost heaving is caused by the expansion of soil volume due to the formation of ice within pore spaces, and also by drawing water to the freezing front of ice lenses. If a frozen soil is subjected to warming, and the contained ground ice melts, the liquid water content in the soil increases. If the water is prevented from draining due to the presence of underlying permafrost or other confining layers, the soil may become saturated and its mechanical strength is reduced. This weakening can be significant in soils composed of loose sand or non-plastic silt when subjected to cyclic stress induced by seismic vibrations. Thermokarst features are formed by the melting of ice within a given soil leaving local voids and potentially causing the ground surface to subside. Subsidence is most pronounced in ice-rich soils, especially those with large bodies of ground ice. Generally, frost heave, subsidence, thermokarst features, and solifluction are more likely to occur in silt and clay-rich soils. Areas of coarse-grained sediment and bedrock exhibit these features less frequently.

Seismicity

The northern portion of the proposed Project area, from the Beaufort Coastal Plain to the Brooks Range, experiences regionally low seismicity (Plafker et al. 1994). The Beaufort Coastal Plain, Brooks Foothills, and Brooks Range ecoregions comprise the Arctic Tundra, which has experienced three earthquakes in the last 50 years that were greater than magnitude 5.0 within 50 miles of the proposed Project area (AEIC 2011). South of the Yukon River, the proposed Project would cross two seismic zones that trend northeast through the Ray Mountains ecoregion, including the Minto Flats and Fairbanks seismic zones. The Minto Flats seismic zone is a northeast-southwest striking zone of earthquakes between the Tintina Fault to the north and the Denali Fault to the south. The north end of the Minto Flats seismic zone was the locality of a magnitude 6.0 earthquake in 1995 (Freymueller et al. 2008). The Fairbanks seismic zone runs 75 miles from the Alaska Range Foothills to northeast of Fairbanks. No single fault has been identified as the source of the Fairbanks seismic zone, but rather, the source consists of a network of northeast trending high angle faults with sinistral and normal displacements (Kolkeri 2007). The Fairbanks seismic zone has been the locality of many earthquakes including a magnitude 7.3 in 1904, magnitude 6.1 in 1967, magnitude 5.2 in 1981, and 7.2 in 1947 (AEIC 2011). Two other seismic zones that could generate earthquakes producing strong ground motion in the proposed Project area are the Rampart and Dall City seismic zones. The Rampart seismic zone is situated between the Kaltag fault and Tintina fault system, northwest of Fairbanks. This area was the location of a magnitude 5.0 earthquake about 15 miles south-southeast of the Village of Rampart in 2003. This earthquake was felt strongly by residents throughout the area. Eight minutes after the earthquake there was a magnitude 4.3 aftershock. The largest recorded earthquake in the Rampart seismic zone was a magnitude 6.8 that occurred in 1968.

North of the Rampart seismic zone is a cluster of earthquake activity known as the Dall City seismic zone. Very little is known about this seismic zone that generated a magnitude 5.2 in 1969 and five earthquakes greater than magnitude 5.0 in 1985, the largest of which was a magnitude 6.1 (AEIC 2011). The proposed Project may cross the projection of the Kaltag and Tintina fault systems, but the location of these faults at the alignment crossing is unknown. The intermontane region includes the Kobuk Ridges and Valleys, Ray Mountains, Yukon-Tanana Uplands, and the Tanana-Kuskokwim Lowlands ecoregions. This region has experienced 23 earthquakes in the last 50 years that were greater than magnitude 5.0 within 50 miles of the proposed Project area (AEIC 2011).



Source: USGS, Brown et al. 2001

FIGURE 5.1-3 Alaska Stand Alone Gas Pipeline Permafrost Extent

The Alaska Range Transition has seen the most seismic activity since 1960 with 88 earthquakes greater than magnitude 5.0 within 50 miles of the proposed Project area and includes the Alaska Range and Cook Inlet Basin ecoregions (AEIC 2011, Figure 5.1-2). A major fault in the proposed Project area is the Denali Fault. The Denali Fault is several hundred miles long with movement recorded in several locations along its length (APSC 2007, Plafker et al. 1994). Two large earthquakes, magnitude 7.2 and 7.9, occurred on the Denali Fault in 1912 and 2002, respectively. North of the Denali Fault, on the north side of the central Alaska Range, there is an active, northward-vergent fold and thrust belt called the Northern Foothills Fold and Thrust Belt. This fold and thrust belt has been active through the last 3 million years, and extends from the area near Mount McKinley to east of the Richardson Highway (Tok River valley) (Freymueller et al. 2008, Bemis 2010, Figure 5.1-2). Two other active faults, the Healy Creek fault in the north-central Alaska Range foothills, and larger Castle Mountain Fault in the Cook Inlet Basin ecoregion, are also located near the proposed Project area. The Healy Creek fault is a major, steeply north dipping reverse fault that is defined on the east side by the Nenana River and is part of the Northern Foothills Fold and Thrust Belt. On the high terrace immediately east of the Nenana River, the Healy Creek Fault forms a prominent scarp more than 6 miles long. However, it is not clear that the fault continues across the Nenana River (Bemis 2010). The Castle Mountain Fault is the only known active fault in the greater Anchorage area with an identified surface rupture. The fault lies along the southern margin of the Talkeetna Mountains (Freymueller et al. 2008, Figure 5.1-2). Both the 62-mile long eastern and 39-mile long western parts of the fault are seismically active. The fault produced light to moderate magnitude 5.7 and 4.6 earthquakes in 1983 and 1996, respectively. The most recent significant earthquake along the western portion of the fault was about 650 years ago, which suggests the possibility a significant earthquake (~magnitude 6.0) may be expected in the near future (Hauessler et al. 2002).

Southern Alaska, particularly south of the Chugach Mountains, has experienced considerable seismic activity in recent history. However, most earthquakes occur along the Alaska-Aleutian megathrust, which has produced four major earthquakes in recent history, including a magnitude 8.6 in 1964 (Cohen 1995), a magnitude 7.5 in 1979, a magnitude 7.8 in 1988, and a magnitude 7.9 in 1987 (AEIC 2011). Surface fault rupture is another potential geologic hazard, which is defined as the dislocation of the surface of the earth related to motion along the fault at depth. Ground cracking related to surface fault rupture can occur along the fault and away from the fault (DGGS 2011).

Glacial Processes

Rocks and sediments are added to glaciers through various processes. Glaciers erode the terrain principally through two methods: abrasion and plucking. Plucking occurs when subglacial water penetrates the fractures and freezes, which acts like a lever that loosens the rock by lifting it and separating the fractures from the bedrock. Abrasion occurs when the rocks frozen into the bottom of the ice act like grit in sandpaper, resulting in landforms such as U-shaped valleys, cirques and moraines, and rivers with high sediment content (NSIDC 2011).

Glacial outbursts, also known as jökulhlaups, occur when the ice dam holding back glacial melt water fails. What results is a large discharge of melt water that has the potential to affect infrastructure in its path, including the pipeline (Alden 2012).

Surging glaciers are glaciers that advance rapidly at regular intervals. Some glaciers in full surge can advance up 100 meters per day (333 ft). Surging glaciers are caused by internal instabilities within the glacier. Surging glaciers occur in the St. Elias Mountains, eastern Wrangell Mountains, and Alaska Range, but few, if any, are found in the Chugach Mountains (Pedersen 1978).

Fluvial Processes

Fluvial processes comprise the motion of sedimentation and erosion on a river bed. In addition to the effects of normal mechanical erosion, which includes both bank erosion and stream bottom erosion, running water also has the ability to thaw permafrost. The thawing of permafrost is evidenced by the existence of taliks, or unfrozen zones, beneath the channels of all rivers that do not freeze to their bottoms during winter. Where large river channels are incised within ice-rich and/or relatively unconsolidated sediments, lateral erosion can form thermo-erosional niches, often greater than 30-feet deep. This process can cause bank collapse, which often occurs in large blocks along ice wedges. This process occurs widely along the banks of the Yukon River (French 2007).

Coastal Processes

Coastlines change shape and location in response to natural forces and human activities. Sand and other materials are moved onto and off of beaches by currents and waves. Seasonal movement of coastal materials creates broad summer beaches followed by narrow winter beaches in an annual cycle. During major storms, huge waves and storm surges can move large amounts of coastal sediments and can flood vast coastal areas in a matter of hours. Coastlines move as a way to achieve equilibrium with the forces acting against them. Barrier islands and offshore sand bars move landward and along the coast, driven by long shore currents. Headlands are eroded back, moving the coast inland. Sediment deposited on river deltas will act to extend the coast out into the water. Coastlines also move inland in response to changes in sea level.

Coastal retreat at the northern pipeline terminus has the potential to impact the dock facility serving the proposed Project, due to the moderate-high rates of erosion and bank retreat in the Prudhoe Bay area. Prudhoe Bay has experienced effects of northern Alaska's coastal erosion problem. The pipeline terminus is situated about a half a mile from the nearest shoreline of Prudhoe Bay and behind an existing central natural gas facility.

5.1.1.3 Paleontological Resources

Paleontological resources are defined as any physical evidence of past life, including fossilized remains, impressions, and traces of plants and animals. Fossils occur throughout Alaska and range from single-celled organisms to large vertebrates, including Mesozoic dinosaurs, marine reptiles, and Pleistocene megafauna. Paleontological evidence in Alaska varies, and with respect to the proposed Project area, can be characterized broadly. Fossilized plants of marine and terrestrial origin, as well as invertebrate and vertebrate animal specimens, have been found in the area of the proposed Project.

The North Slope is particularly rich in paleontological remains. The oldest fossil recovered from the North Slope, a tooth plate from a vertebrate fish found in Middle Devonian strata, was dated at 380 million years ago (Lindsey 1986). Post-Devonian sedimentation on the North Slope has, in some cases, accumulated up to 20,000 feet of fossil-bearing strata. Marine invertebrate fossils include bryozoans, brachiopods, pelecypods, gastropods, ostracods, cephalopods, crinoids, trilobites, belemnites, ammonites, and corals. By the Middle Jurassic and through the Cretaceous (about 160 to 65 million years ago), trees and terrestrial plants appear throughout North Slope fossil assemblages, recording transgressions and regressions of ancient seas. Twelve types of dinosaurs from the Late Cretaceous have been found, most of which were primarily located along the banks of the Colville River (BLM 2001). Fewer invertebrate fossils occur in Tertiary beds along the Beaufort Coastal Plain. No fossils are known that date from Oligocene or Miocene formations.

Marine and terrestrial mammal fossils (such as otter, seal, whale, mammoth, moose, caribou, musk ox, bison, antelope, camel, horse, and steppe lion) and birds have been found in Quaternary glacial deposits along the Colville River. Fossils of Pleistocene voles and megafauna, including mammoth, mastodon, antelope, musk ox, elk, moose, and saber-toothed cats, have been found in frozen silts and peat bogs along the South Fork Koyukuk, Yukon, and Tanana rivers in the Ray Mountains. Invertebrate fossils (pelecypods, gastropods, and insects) also occur in a variety of Quaternary deposits (Péwé 1975).

Paleontological resources along the Sagvanirktok River, located approximately 7-10 miles away from the proposed Project area, consist of small fossils of invertebrates, shells, and corals found in the metamorphosed rocks of the Brooks Range. These fossils have been examined and collected by scientists, particularly by members of the U.S. Geological Survey, over the past 30 years. They provide information useful in dating formations and establishing the geological sequence related to life forms (Reifenstuhl 1991).

5.1.2 Environmental Consequences

5.1.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed and there would therefore be no effects to soils or geology.

5.1.2.2 Proposed Action

Anticipated impacts to soils and geology as a result of the proposed Project are related to pipeline segments and alternatives and above ground facilities. This section identifies general impacts from construction and operation, and discusses impacts specific to regional geology and topography, permafrost and soils, material resources, and paleontological resources.

Construction

Open cut would be the most common method utilized for construction of the pipeline, and is accomplished by excavating a trench and placing the pipe into position. Excavation is classed as stripping, ditching, or trenching of rock or borrows. At the compressor station sites, access roads, and borrow areas, stripping excavation would be used. Stripping excavation consists of the excavation, removal, and disposal of all surface organic material, silt, and unsuitable overburden necessary to expose suitable foundation conditions. In situations where topsoil removal is required, the topsoil would be segregated and saved when practical to aid surface rehabilitation and future revegetation of the area.

During the geotechnical investigation for the pipeline and possible material source sites, topsoil will be characterized within the pipeline ROW to develop topsoil segregation requirements for the construction of the proposed Project. The organic soils typical of many locations on the North Slope are easily damaged, which can affect the depth of the active layer and thereby, the depth to permafrost and the drainage patterns of the site. In areas where mineral soils are exposed, the active layer is likely to be considerably deeper than in areas with good vegetative cover. These exposed sites are likely the result of frost action resulting in cryoturbation. In areas of low centered polygons, the ice wedges between the polygons may extend from a few feet to 20 feet or more in depth. When surface hydrology alters the availability of water on ice wedges, the result may become high centered polygons with deep fissure between them that could expose a pipeline. This is also likely to alter vegetative communities towards a dryer regime. In areas with large rocks mixed with finer material, the frost action may create sorted circles in which the larger stones are forced upwards to the surface and may disrupt buried objects. In areas of very coarse material such as along rivers and deltas, there may be no permafrost and very little vegetation, so disturbance is less likely to have long lasting impacts (Geisler 2012, Rieger et al. 1979).

Within the ROW, trench excavation would utilize conventional excavation equipment, such as mechanical ditchers, draglines, dredgers, clams, or backhoes for most of the length of the Proposed Project except for the first 6 miles. Steeper terrain would require a greater amount of either cut or fill during construction than in flatter terrain, and would therefore have a greater impact on the topography because the excavated slope areas could more easily erode. Normally, steeper terrain causes greater impacts. In these areas, the ROW would be expanded from 100- to 230-feet wide to allow for excavation into the side slopes of the surrounding area to minimize erosion.

Any action that involves ground disturbance could create a potential for impacts to paleontological resources existing in the proposed Project area. Pleistocene fossils discovered along the TAPS ROW necessitated their removal at the time of discovery, and similar discoveries along the proposed Project ROW are reasonably likely. Given the variability of the scientific importance of these resources, the potential for adverse impacts exists which the AGDC would mitigate, if these resources are discovered as part of the proposed Project.

Temporary localized drainage pattern alterations (e.g., diversions) could occur during construction to accommodate pipeline installation and equipment staging. The AGDC proposes to identify measures that would mitigate long-term impacts to local drainage patterns during engineering design.

Some areas could require drilling and blasting that would be controlled and monitored. Blasting could be required to fracture high-density frozen soils or bedrock prior to trench excavation. Safety-controlled blasting techniques would be used in all situations where blasting is required within proximity to inhabited areas or existing facilities. A Blasting Control Plan would be developed to mitigate health, safety, environmental impacts, and notify residents that may live in the vicinity when blasting activities will occur.

Temporary ice roads and ice pads would be constructed to stage and transport materials and equipment, which would allow the work to be less disruptive to the proposed Project area. Although thaw settlement could result if the ice road compaction of vegetation appreciably decreases the insulating capacity of the active layer (Felix et al. 1992), investigations addressing ice road impacts show impacts are confined to the vegetative layer, thereby limiting impacts to soils containing permafrost (Walker et al. 1987).

Wintertime construction offers the ability to reduce the work pad thickness or to eliminate gravel pads altogether. Access roads to the pipeline are planned and construction methods to appropriately mitigate these conditions would be defined during detailed engineering. The construction of gravel pads and roads on permafrost requires a thickness of fill equal to or greater than the depth of the summer thaw. The addition of fill effectively increases the insulating capacity of the active layer and prevents destructive thaw settlement (NRC 2003, Klinger et al. 1983).

Sands, gravels, rip rap, and other materials would be required at various locations for infrastructure, pad construction, and production and ancillary facilities along the proposed Project ROW. Local impacts due to the removal of geological material would occur. The AGDC has estimated that approximately 13.1 million cubic yards of material may be required for total proposed Project construction. Of this, approximately 6.18 million cubic yards may be required for side slope cuts and fills, 90 percent (71 aggregate miles) of which will be used in small segments between MP 142 and MP 429 of the proposed Project. Sand and gravel sites along the proposed Project ROW would provide needed borrow material. Although geotechnical data regarding material availability is in development, a total of 546 existing material sites along the main alignment have been identified using existing Alaska DOT&PF material site information sources and are listed in Appendix 6 of the Alaska Stand Alone Gas Pipeline Plan of Development Revision 1 dated March 2011 (Appendix P). Table 5.1-3 displays material availability along major sections of the route.

TABLE 5.1-3 Material Availability and Need by Construction Spread

Spread	Location	Length (Miles)	ASAP Material Needs (CY)	Material Available within Mining Plan Work Limits at Active Open Sites (CY)*	Number of Active Open Sites Only	Material Available within Mining Plan Work Limits at All Sites (CY)*	Total Number of Sites
1	GCF to Chandalar Shelf	183	2,501,000	7,800,000	15	15,800,000	49
2	Chandalar Shelf to Yukon River	177	5,375,000	2,850,000	26	11,950,000	76
3	Yukon River to Healy	169	3,410,000	11,050,000	44	26,050,000	164
4	Healy to South Terminus	208	1,793,000	15,000,000	59	39,850,000	257
	Mainline Total:	**737**	**13,079,000**	**36,700,000**	**144**	**93,650,000**	**546**

*Note: The spreadsheet in Appendix P allocates ASAP material needs to only open active sites within the existing mining plan work limits.

Impacts associated with obtaining material from these resources would include modifications of local topography, loss of surface vegetation, creation of landscape scars, and a temporary increase of soil erosion and siltation near the operation material sites (OMS). In some OMS, thawing of permafrost could produce ponding. Prior to OMS development, Material Site Mining Plans and Reclamation Plans would be developed to reduce impacts associated with material extraction.

Acid mine drainage refers to the outflow of acidic water from a mining site. Although mining is by far the largest cause of this type of acid leaching, the process can also occur during non-mining land disturbances such as construction or naturally in some environments, known as acid rock drainage. Acid mine drainage is a major problem with many hard rock mines, as well as coal mines.

No outcrops of acid generating rock are known near the proposed Project area. All known mines that have acid drainage are located well away from the proposed Project area, with the closest of which located over 500 miles from the proposed Project. Red Dog mine is in Northwest Alaska. Other mines known to have acid drainage problems include the Kensington, Greens Creek, and (now inactive) Salt Chuck Mines, which are located in Southeast Alaska (Coil, McKittrick, & Higman 2010). The likely areas for borrow materials will come from sources that are listed in Appendix P – Existing Material Sites.

The proposed Project route would cross two seismic zones and five fault lines. Seismic activity can trigger mass wasting processes such as landslides and soil instabilities including liquefaction. The currently proposed pipeline is designed to resist seismic activity, but is not capable of withstanding landslides. The proposed Project would be routed so that previous landslide areas are avoided to the extent practicable. Potential landslide areas that cannot be avoided by route selection will be stabilized prior to pipeline construction, and pipeline segments crossing potential liquefaction areas will be ballasted for neutral buoyancy to mitigate these hazards.

The pipeline will be designed to address frost heave potential and other geomorphic processes. The design model being used to address frost heave will also address future possible changes if permafrost gets warmer. The Applicant Proposed Mitigation Measures (Section 5.23, Mitigation) contain provisions for designing the pipeline system to take into account the thermal regime of the soils and using engineering controls such as insulation and non-frost-susceptible fill to control the thermal signature of the pipeline. Furthermore, the pipeline monitoring program will identify changing soil and rock conditions so that corrective actions can be taken before pipeline integrity is threatened.

Operations

The proposed Project may affect adjacent permafrost by heat transfer. In concept, the pipeline would be operated at below freezing temperatures in predominantly permafrost terrains, and above freezing temperatures in predominantly thawed-ground settings. The operating temperature of the buried pipeline could affect the frozen/thawed nature of the surrounding subsurface which, in turn, could affect the pipeline trench support conditions. The operating temperature could also potentially cause surface expression such as local subsidence or heave. If the pipeline has a higher temperature than the surrounding subsurface environment, it could create an area of thawed material along the proposed ROW. Frost heave and thaw bulbs should be mitigated to avoid creating an unstable ground surface that could be prone to impacts such as erosion.

Conversely, permafrost aggradation could occur in areas where the pipeline is operated at below-freezing temperatures. This might occur in the discontinuous permafrost zone wherever the pipeline (operated at or below freezing temperatures) crosses unfrozen ground; there would be moisture migration towards the pipeline and resulting frost heave when the moisture freezes. Even in areas where permafrost is absent, ground ice could grow, producing frost heave in some areas, especially in areas where thawed, fine-grained soils are dominant in the subsurface. Where the pipeline traverses from unfrozen, stable ground to ice-rich, unstable ground, or visa-versa, thaw settlement could occur (French 2007). The AGDC proposes to identify site specific measures to mitigate impacts to permafrost and soils during engineering design with optimization primarily accomplished by constructing facilities in the winter while the ground remains frozen.

During operations, maintenance activities would involve maintaining vegetation along the permanent ROW to a low height to allow for aerial patrol safety inspections. In addition, areas that were unsuccessfully revegetated would be reseeded with native plant species. No further impacts to geology and soils are anticipated from these maintenance activities.

Yukon River Crossing Variations

The proposed Project proposes to cross the Yukon River in one of three ways including a suspension bridge to be constructed (the Applicant's Preferred Option), the existing highway bridge (Option 2), or through horizontal directional drilling (HDD) method (Option 3). For the the Applicant's Preferred Option, footings and abutments for a new bridge would be constructed and would require strict adherence to erosion and sediment control measures. The impacts to soils and geology would be caused by the excavation needed to place the foundations of the bridge. However, no permanent structures, such as footings, would be installed within the Yukon River, which would prevent impacts to soil and geological resources within the river related to increased sedimentation and accretion, among others. Impacts to soil and geological from Option 2 would be negligible since there would be no ground disturbance. The feasibility of Option 3, HDD crossing, is unknown at this time due to the limited soil information. Further study is required to investigate and evaluate the in-situ soils, analyze scour limitations, and address seismic concerns. Nevertheless, gravel pads placed on both sides of the river would require strict adherence to sedimentation and erosion control. A discussion of the potential impacts of using the HDD crossing method on waterbodies and wetlands is provided in Sections 5.2 Water Resources and 5.4 Wetland Resources.

5.1.2.3 Denali National Park Route Variation

The proposed Denali National Park Route Variation would follow in close proximity to the Parks Highway corridor through Denali NPP primarily from MP 540 to MP 555. The route would typically be placed within the road ditch near the toe of the road slope on the east side of the road. Localized erosion control methods would be required to control erosion along roadside ditches and retaining walls may need to be constructed along portions of the roadway. . AGDC is currently evaluating the feasibility of using HDD to construct the pipeline beneath the steep slope up to MP 541 to mitigate visual impacts to the slope. It is not known whether the soils in this area are discontinuous permafrost, or non-permafrost. Geotechnical studies will be required to characterize local soils. Work along the route variation would require the disposal of a significant volume of asphalt that would be disposed of in compliance with ADEC regulations.

South of the Canyon commercial area, the pipeline would cross the Nenana River on an existing pedestrian/bicycle bridge and enter the Denali NPP. The pipeline would pass under the Nenana River a second time as a buried crossing at McKinley Village and would continue south along the Parks Highway ROW. During construction related asphalt removal, only one lane of the traveled roadway would be utilized.

The first river crossing would not require excavations as the pipeline would be attached to an existing bridge. However, the buried river crossing would have benches prepared for equipment to use HDD techniques.

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5.2 WATER RESOURCES

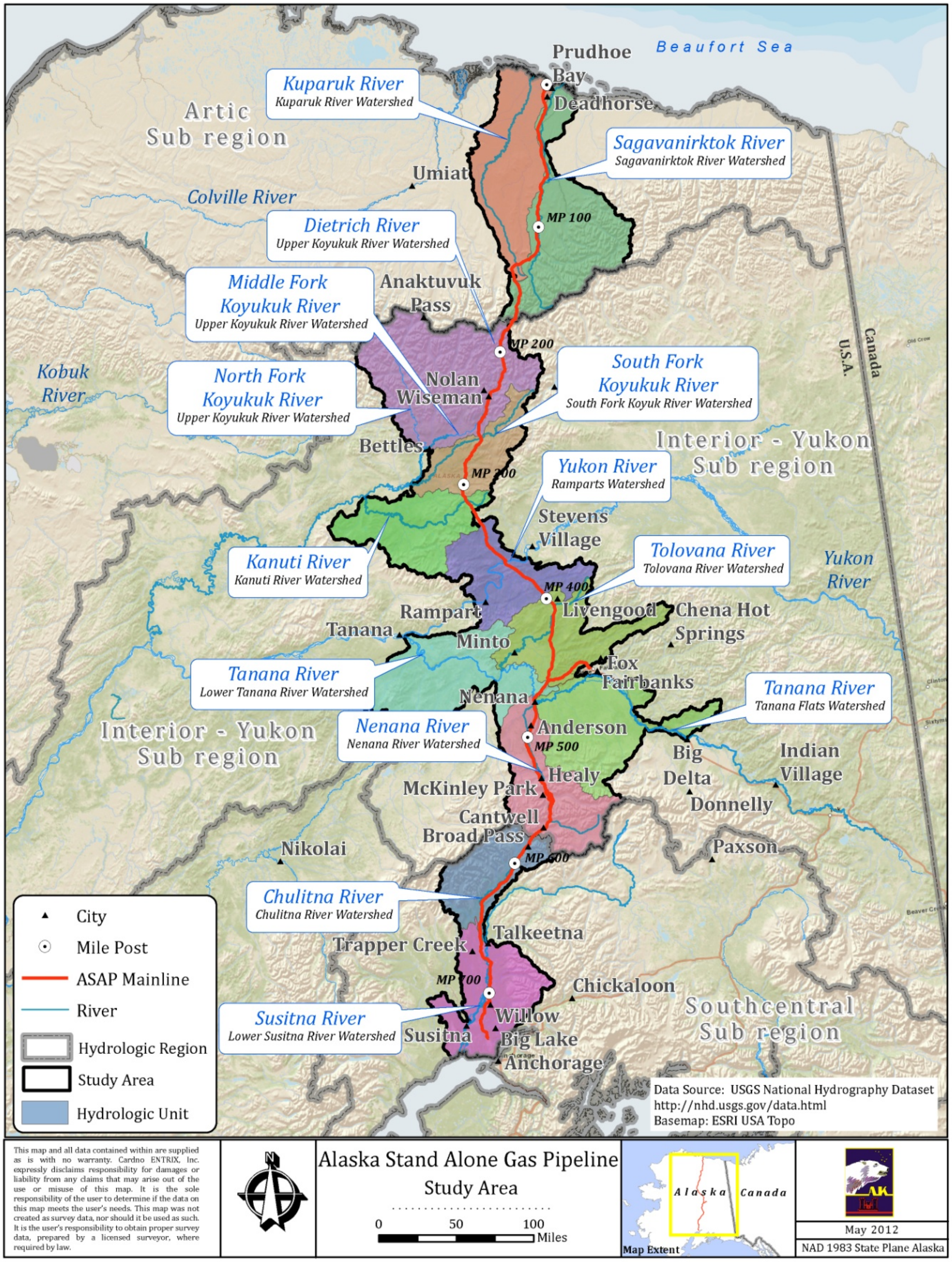
This section discusses the surface water, groundwater and floodplains potentially impacted by the preconstruction, construction and operational activities along the proposed 737-mile proposed Project right-of-way (ROW). It includes the Fairbanks Lateral, aboveground facilities, support facilities, and the Denali National Park Route Variation. The Alaska Gasline Development Corporation (AGDC) has proposed mitigation measures to reduce impacts to water resources, which are discussed in detail in Section 5.23.2.

5.2.1 Affected Environment

The proposed Project area crosses 9 watersheds that are potentially affected by the proposed activity and the alternatives. A watershed is an area of land that drains all of the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel (United States Geological Survey [USGS] 2011c). It is the divide separating one drainage basin from another and consists of surface water lakes, streams and wetlands, and all the underlying groundwater. The total drainage area of all 9 watersheds that comes in contact with the proposed Project area is 47,983.26 sq. miles (Figure 5.2-1).

The USGS defines water resources by region (Alaska), subregion (Arctic, Interior-Yukon, and Southcentral), accounting unit, and cataloging unit, or watershed (USGS 1987). The USGS collects and disseminates reliable, impartial, and timely information that is needed to understand water resources in the United States. Much of the information discussed in this section has been obtained from the USGS Water Data for Alaska. These water resources include surface water, groundwater, water quality, and water use in Alaska collected in or near the proposed Project ROW. Additional information was obtained from Alaska Department of Environmental Conservation (ADEC) and United States Environmental Protection Agency (EPA) sources as noted below.

This section also describes the federal, state, and local rules and regulations for water use in Alaska. Water resources for the Arctic, Interior, and Southcentral regions are discussed in detail in relation to potential preconstruction, construction, and operational impacts of the proposed Project.



Source: USGS 2011a.

FIGURE 5.2-1 Hydrological Unit Subregions and Watersheds along the proposed Project ROW

5.2.1.1 Surface Water

Surface water is defined as water that is on the Earth's surface including streams, rivers, lakes, estuaries, and reservoirs (USGS 2011b). The proposed Project area encounters numerous rivers, lakes, streams, and wetlands along the 737-mile route. There are no estuaries found within the proposed Project area. Impacts to wetlands within the proposed Project area are discussed in detail in Section 5.4, Wetlands.

Types of Surface Waterbodies

The types of surface waterbodies found within and surrounding the proposed Project area include rivers and streams which can be complex (braided streams, split channels, or alluvial fans) or single channels (USGS 2010a; BLM 2002). These complex systems are defined as:

- Braided stream: A stream characterized by an interlacing or tangled network of several small branching and reuniting shallow channels;
- Split channels: Rivers with more than one main channel;
- Alluvial fans: Refers to fan-shaped sediments of gravel, sand, silt, clay, or other particulate rock material deposited by flowing water, usually in the beds of rivers and streams, on a floodplain, on a delta, or at the base of a mountain; and
- Single channels with floodplains: Rivers or streams that exhibit one primary channel.

Surface Water Availability

The USGS National Hydrography Dataset (NHD) is a digital vector dataset used in Geographic Information System (GIS) analyses, which include data on lakes, ponds, streams, rivers, dams and stream gauges. The USGS NHD does not provide water depth information. Specific data includes flow networks, discharge rates and water quality. The rivers and streams that the Project proposes to cross are shown in Appendix E. The location (latitude/longitude and nearest pipeline milepost [MP]), surface area, and type for all lakes and ponds within 1 mile of the proposed Project right-of-way (ROW) is provided in Appendix F. There also may be data from studies that cover just a specific portion of the proposed Project area. If available, this data is included under the respective hydrologic subregion. There may be some data on depth from the Alaska Department of Natural Resources (ADNR), Division of Mining, Land and Water on waterbodies for which the ADNR has issued a Temporary Water Use Authorization (TWUA); however, this is not available on-line. The University of Alaska Fairbanks (UAF) Water and Environmental Research Center (WERC) website includes minimal (2005-2008) water quality data for a few lakes over a few months in the year, all located in the National Petroleum Reserve Alaska (NPRA) and Kuparuk Watershed. Some lakes are currently being used for water withdrawal or have been withdrawn from in the past, and some are reservoirs (man-made). All lakes in this database are a considerable distance from the proposed Project.

Surface Water Use

Surface water use is dependent on the surrounding population and activities occurring in that area. The USGS compiles data on water use in the United States at the county (borough or census area) level (USGS 2010b). Table 5.2-1 illustrates the 2005 (most recent) estimated fresh surface water withdrawal data for the boroughs and census areas along the proposed Project ROW, in million gallons per day (MG/day). Boroughs and census areas are shown in the Federal Emergency Management Agency (FEMA) Floodplain Maps provided in Appendix G. Commercial, wastewater release, and hydroelectric power in-stream use data was not collected for 2005 (Kenny et al 2009). All drinking water protection areas are included in Appendix G.

TABLE 5.2-1 2005 Estimated Fresh Surface Water Withdrawals by Borough or Census Area (MG/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power	Total (MG/day)
North Slope	0.36	0.01	0.0	0.00	0.0	0.0	0.65	0.0	1.02
Yukon-Koyokuk	0.04	0.0	0.0	0.0	0.0	0.0	0.41	0.0	0.45
Fairbanks North Star Borough	0.0	0.0	0.0	0.0	0.02	0.38	10.16	15.80	27.13
Denali	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.00	15.00
Matanuska-Susitna	0.0	0.0	0.0	0.02	0.05	0.0	0.86	0.0	0.93

Source: USGS 2010b.

Descriptions of the types of water uses in Table 5.2-1 are provided below (USGS 2009):

- Public-supply water is water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic (not self-supplied), commercial, industrial (not self-supplied), thermoelectric-power, and public water use;
- Domestic self-supplied water use is water used for indoor household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and outdoor purposes such as watering lawns and gardens. (Self-supplied water use is water withdrawn from a groundwater or surface-water supply source by a user rather than being obtained from a public supply);
- Industrial self-supplied water is water used for fabrication, processing, washing, and cooling;
- Irrigation water is water that is applied by an irrigation system to assist crop and pasture growth, or to maintain vegetation on recreational lands such as parks and golf courses;

- Livestock water is water used for livestock watering, feedlots, dairy operations, and other on-farm needs;
- Aquaculture water is water use associated with the farming of organisms that live in water (such as finfish and shellfish) and off stream water use associated with fish hatcheries;
- Mining water is water used for the extraction of naturally occurring minerals including solids (such as coal, sand, gravel, and other ores), liquids (such as crude petroleum), and gases (such as natural gas); and
- Thermoelectric-power water is water used in the process of generating electricity with steam-driven turbine generators. (Refers only to self-supplied thermoelectric-power withdrawals, otherwise included in "public-supply water use" category.)

Surface Water Quality

Surface water quality data are sparse in Alaska. Some sources are the EPA's Significant Non-Complier (SNC) list, the USGS, and the ADEC Division of Water. The SNC list is a tool created by the EPA to help State Drinking Water (DW) Programs track Public Water Systems (PWS) that are deemed by EPA to be significantly out of compliance with Safe Drinking Water Act (SDWA) regulations. The USGS provides information on Alaska's rivers and streams, groundwater, water quality, and operates the most extensive satellite network of stream-gauging stations in the state (USGS 2011c). The ADEC Division of Water has a role of protecting and improving water quality in Alaska by establishing standards for keeping water clean, and regulating discharges into waters and wetlands (ADEC 2011d). The UAF WERC website includes some (ice thickness, dissolved oxygen (DO), and conductivity) water quality data between 2005 and 2008 on a few lakes found in the Kuparuk Watershed. Additional water quality information may be included from studies that cover a specific location within the proposed Project area. If available, this data is included under the respective hydrologic subregion.

There are relatively few (200) USGS stream gauge sampling sites in Alaska in relation to the amount of surface water present. The USGS data that is available is often out of date and usually does not cover many water quality parameters. Two or three representative stream gauges were identified within each watershed (or Hydrologic Unit Code [HUC]) within or as close as possible to the proposed Project area (USGS 2010d). For the proposed Project area along the existing Trans Alaska Pipeline System (TAPS) ROW, data collected prior to 1977 was generally not considered representative because it pre-dates the TAPS project development. Otherwise, data was considered to be representative if collected after 1970. Data sites were initially selected based on:

- Collection date (post-1977 or post-1970 as described above);
- Proximity to the proposed Project area (preferably no further than ten miles from the proposed Project area);

- Proximity to each other (preferably no further than about 50 miles apart along the proposed Project alignment); and
- Parameters monitored (preferably with data for at least two of the selected parameters, like temperature and color).

If sites could not be found that met all of the criteria listed above, then the gaps were filled in with the next best data found. For instance, if there were no sampling sites within about 50 miles of each other with post-1977 data in an area near the TAPS, then sites with older data were listed. Finally, if 2 sites that meet all criteria were closer than 10 miles apart, the site with the most recent data was selected. A discussion on the representative data for a given watershed is presented in each section.

The surface water and groundwater monitoring sites maps presented in Appendix G illustrate locations of the selected USGS surface water quality sampling sites. The ADEC Division of Water does not have a centralized database of surface water quality; however, they do list impaired waterbodies in “Alaska’s Final 2010 Integrated Water Quality Monitoring and Assessment Report” (ADEC 2010). These are discussed in the following sections under the respective hydrologic subregion.

The ADEC Drinking Water Program requires PWS’s (both surface water and groundwater) in the state of Alaska to comply with drinking water regulations in 18 AAC 80 in accordance with the Federal Safe Drinking Water Act (ADEC 2011a). Each category under the PWS that supply water to the consumer has their own set of regulations that must be met:

- Community Water System (CWS):
    - Expects to serve, year round, at least 25 individuals;
    - Is expected to serve, year round, at least 15 residential service connections.
- Non-Transient Non Community Water System (NTNCWS):
    - Regularly serves the same 25 or more individuals for at least 6 months of the year.
- Transient Non Community Water System (TNCWS):
    - Is not a CWS or NTNCWS;
    - Regularly serves at least 25 individuals each day for at least 60 days of the year.
- Class C Public Water System:
    - Is not a CWS, NTNCWS, or TNCWS system, and is not a private well or a duplex.

The types of contaminants that are regulated are:

- Bacteria, Viruses (from septic systems, etc.) and parasitic protozoans;
- Lead and Copper;
- Nitrate and Nitrite (commonly from septic systems and manure piles);

- Heavy Metals like Arsenic and Cadmium;
- Volatile Organic Contaminants (VOC) like benzene and gasoline;
- Synthetic Organic Contaminants (SOC) like pesticides and herbicides; and
- Other Organic Compounds (OOC) like Dioxin and polychlorinated biphenyls (PCBs).

The ADEC is not responsible for overseeing private water systems. A PWS can be assumed to be generally in compliance with existing EPA standards, unless they are on the EPA's SNC list. An SNC is a system whose serious, frequent, or persistent non-compliance of drinking water regulations has met the SNC criteria as defined by the EPA for a specific rule. The EPA assigns PWSs a point total, based on violations they have received over the past 5 years (unless they have returned to compliance). The EPA assigns a higher weight to violations of a health-based standard. The EPA also adds in the number of years the PWS has been out of compliance to determine the total score. PWSs with a score of 11 or higher are considered a national enforcement priority and included on the SNC list which is published quarterly. The EPA's SNC list as of July 2011 has no PWSs near the proposed Project area that have surface water as a primary source (ADEC 2011b). Sections 5.2.1.5 (Arctic), 5.2.1.6 (Interior-Yukon), and 5.2.1.7 (Southcentral) describes surface water for each hydrologic subregion in the study area.

5.2.1.2 Groundwater

Groundwater is the water that flows or seeps downward and saturates soil or rock, supplying springs and wells (USGS 2011b). Groundwater replenishes streams, rivers, and wetland habitats with fresh water from an aquifer. An aquifer is a geological formation or structure that stores and/or transmits water, such as to wells and springs (USGS 2011b). There are different types of aquifers, characterized based on aquifer composition.

Groundwater is protected under ADEC regulation from reported contaminated sites, storage tanks, spill response and specific waste disposal activities (ADEC 2012). The ADEC has implemented a community based effort to protect groundwater sources for public drinking water under the Drinking Water Protection Program (DWPP). The DWPP includes 3 components: source water assessments, groundwater protection, and wellhead protection under the requirements of the Safe Water Drinking Act. Source water is where the drinking water originates; it could be from groundwater through a well, or surface water through a lake or river. Source water assessments identify the potential contamination risk in order to prioritize PWS' so protection efforts can be implemented. This assessment identifies where the water contribution comes from to the source of the PWS which is defined as a protection area. All drinking water protection areas located near the proposed Project are included in Appendix G.

Contaminated sites are also pertinent to the affected environment description for soils and geology (Section 5.1, Soils and Geology). The specific location of pipeline placement in relation to public and private well site locations will be determined later in the process and would avoid potential impacts to water systems.

Groundwater Availability

Groundwater is readily available throughout most of Alaska, except in areas of thick permafrost. Most of Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams. The aquifers that produce groundwater are usually unconfined (i.e., not covered by a layer of silt or clay). In permafrost free areas, the groundwater table generally follows surface topography. The depth to groundwater varies from a few feet to over 400 feet across Alaska (ADEC 2008a).

One source of groundwater data is the DNR's Well Log Track System (WELTS) (ADNR 2011). The WELTS provides information on private wells by meridian, township, range, and section. The information includes owner, date of completion, depth, well status, date of entry, and sometimes remarks. The remarks sometimes provide the well yield and depth to groundwater. The WELTS information found within the proposed Project area is discussed under the appropriate hydrologic subregion below.

Groundwater Use

Groundwater use is dependent on the surrounding population and activities in the area similar to surface water uses. As of 2008, groundwater was a source of drinking water for about 50 percent of Alaska's population, and 90 percent of the state's rural residents. Groundwater is a source for 83 percent of Alaska's 1,602 public drinking water systems (ADEC 2008a). In general, groundwater in Alaska is suitable for domestic, agriculture, aquaculture, commercial, and industrial uses with moderate or minimal treatment (ADEC 2010). The drinking water protection areas are included in Appendix G.

The USGS provides information on groundwater withdrawals in "Estimated Use of Water in the United States in 2005" (USGS 2010b). Table 5.2-2 illustrates the 2005 USGS data on groundwater withdrawals for the boroughs and census areas in the proposed Project area. The definitions of water use categories are listed previously under surface water.

TABLE 5.2-2 2005 Estimated Fresh Groundwater Withdrawals by Borough or Census Area (MG/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power
North Slope	0.01	0.0	0.03	0.0	0.0	0.0	0.0	0.04
Yukon-Koyokuk	0.18	0.02	0.01	0.0	0.0	0.0	0.0	0.21
Fairbanks North Star Borough	7.10	2.47	0.0	0.16	0.02	0.38	1.00	11.13
Denali	0.01	0.11	0.05	0.05	0.0	0.0	1.00	1.22
Matanuska-Susitna	1.32	3.88	0.16	0.34	0.03	0.0	0.0	5.73

unk = unknown value

Source: USGS 2010b.

Groundwater Quality

Groundwater quality data is sparse in Alaska. Possible sources of data are the ADNR's WELTS, the ADEC's Drinking Water Watch Program, the EPA's SNC list, and the USGS. The WELTS database does not have water quality data from wells located within the proposed Project area (ADNR 2011). The EPA's SNC list as of July 2011 includes a total of two PWSs near the proposed Project area that has groundwater as a primary source (ADEC 2011b). This information is discussed under the respective hydrologic subregion in the following sections.

The same general criteria described in the discussion of surface water above, were used for representative USGS groundwater quality sites (Appendix G). Sections 5.2.1.5, 5.2.1.6, and 5.2.1.7 describe known groundwater (including quantity, use, and quality) for each hydrologic subregion in the proposed Project area. Additional concerns regarding groundwater quality are arsenic, contaminated sites, and groundwater recharge areas (STB 2011). The ADEC is not responsible for overseeing private water systems. The owner of a private well is responsible for the water quality and its safety for drinking. EPA rules do not apply to private wells (although some state rules do), but EPA recommends that well owners have their water tested annually (EPA 2012a).

Arsenic

Arsenic has been documented to occur in groundwater in some areas of the proposed Project footprint. In January 2009, the EPA listed 8 water systems in Alaska that were out of compliance with the federal arsenic standard. Most were located in the Matanuska-Susitna Valley. One was located at Willow Elementary, one at the Willow Area Community Center, and one at the Talkeetna Water and Sewer System (White 2009).

Contaminated Sites

As of April 2010, the ADEC listed a total of 33 contaminated sites along the Parks Highway in association with the proposed ROW location. This number was determined by comparing the ADEC contaminated sites database to a 1,000 foot radius from the federal ROW. Of these sites found, 17 have been designated as Cleanup Complete, indicating both soil and groundwater meet the most stringent levels established by state regulations. Four sites are designated as Cleanup Complete with Institutional Controls, indicating there are restrictions in place which apply to site operators, as well as current and future operations. The remaining 12 sites are designated as open, indicating there are ongoing activities to monitor, remediate, or assess site conditions. Site conditions range from disposal locations including unknown quantities released, to historical releases totaling 721 gallons of diesel fuel. These sites are illustrated in Figure 5.2-2.

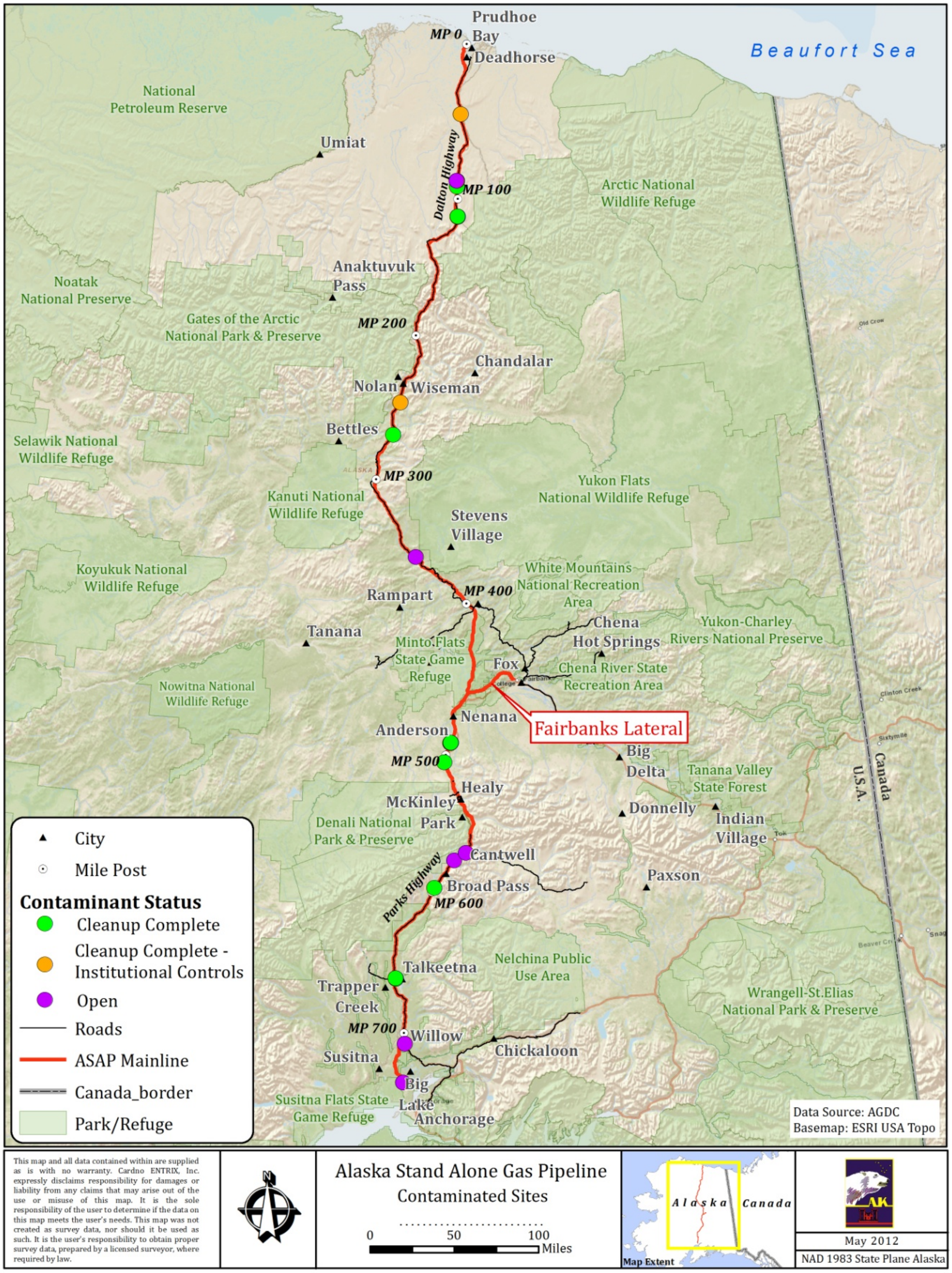


FIGURE 5.2-2 Contaminated Sites

The ADEC regulates the cleanup of contaminated sites to ensure protection of human health and the environment using a risk-based approach. The ADEC's oversight provides the framework to move sites through a designated process towards cleanup through the steps of: identify, assess, rank, prioritize, track, and monitor. The ADEC also strongly promotes the re-use and redevelopment of contaminated properties. An assortment of corrective action methods are used to progress a site towards Cleanup Complete, including excavation, containment, in-situ remediation, site monitoring, and analysis of risk to ensure no unacceptable human health or environment risk remains.

Groundwater is protected through regulation of contaminated sites, storage tanks, contingency plans, oversight of controlled releases or discharges, and underground injections. Through its Spill Prevention and Response Division and Division of Environmental Health, the ADEC maintains oversight and control to many programs which ensure groundwater protection, including Contaminated Sites, Industry Preparedness, Prevention & Emergency Response, Underground Injection Controls, Drinking Water Program, Pesticide Control, Solid Waste, and Water Quality.

One Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site at BP Prudhoe Bay Drill Site 14 by Deadhorse may come within 1,000 feet of the intended pipeline location. Uncertainty in the exact coordinate of this location leads to difficulty excluding this site. Additionally, Brownfield sites (abandoned or unused industrial and commercial facilities available for reuse) are defined on an annual basis. Future Brownfield sites may come within 1,000 feet of the intended location. AGDC would route the pipeline to avoid known contaminated areas to the extent practicable to minimize potential liability and to avoid negatively impacting the remedy that is in place for the CERCLA sites.

5.2.1.3 Floodplains

Floodplains are the strip of relatively flat land bordering a stream channel that is inundated at times of high water (USGS 2010a). Floodplains are valuable hydrological and ecological resources that serve many functions including: the storage of storm water, erosion and sediment control, and wildlife habitat. Populated areas along floodplains can be considered a hazardous area for property development, since floodplains can become inundated during flooding.

Executive Order 11988 requires federal agencies to avoid to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The magnitude (quantity) and timing of peak flows for rivers and streams are dependent on the amount of precipitation and the characteristics of the watershed.

The most detailed floodplain data is from the Federal Emergency Management Agency (FEMA). The FEMA creates Flood Insurance Rate Maps (FIRMs) based on historic, meteorological, hydrologic, and hydraulic data. These maps can be used to identify special flood hazard areas (SFHAs) and predict 100 year floods. Figure 5.2-3 and Appendix G presents available FEMA

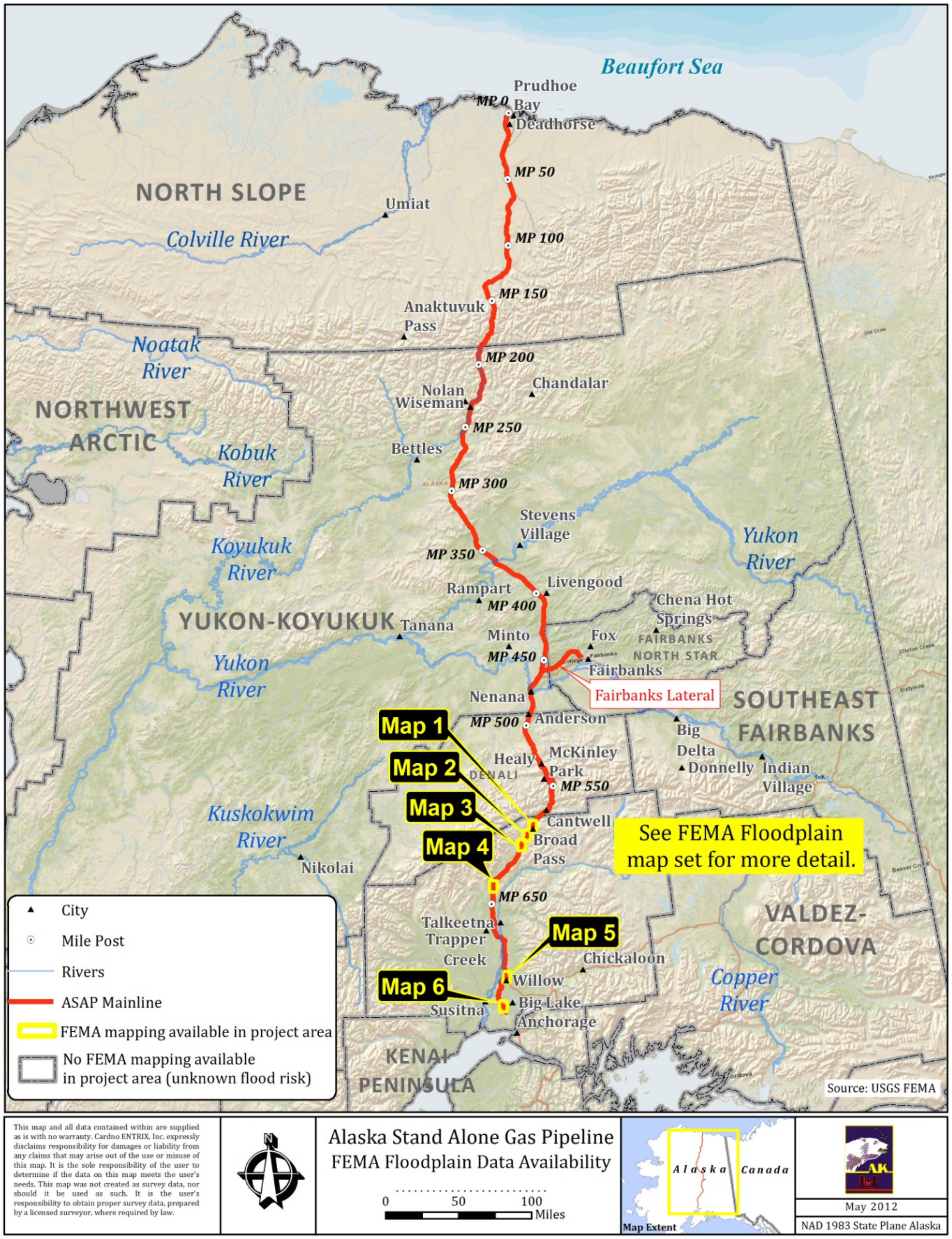


FIGURE 5.2-3 FEMA Floodplains

Floodplain Maps near the proposed Project area by borough or census area (FEMA 2011). The FEMA mapping data available occurs entirely within the Matanuska-Susitna Borough for the proposed Project area. Areas within the proposed Project footprint that are not mapped by FEMA are designated as having possible but undetermined flood hazard risks. For a number of waterbodies in the proposed Project area for which FEMA maps were not available, USGS gauging station data was used. The gauge stations found near the proposed Project area were identified and reviewed for peak stream flow data. Peak stream flow is the highest elevation of water flow measured at the gauge, whereas stream flow is a continuous measurement of water flow. Peak stream flow data will be used in association with FEMA. The locations of these gauging stations for the Arctic, Interior-Yukon, and Southcentral subregions are shown in Appendix G. For each of these subregions, the peak stream flow for a given range of years is identified and shown on a USGS topographic (topo) map. The data available is varied, and is described for each individual stream gauge in the respective hydrologic subregions below.

5.2.1.4 Federal, State, and Local Regulations and Rules

Project construction and operation activities have the potential to impact water resources. Water resources are regulated by federal, state, and local agencies as summarized in Table 5.2-3. The AGDC would complete the necessary permitting requirements in order to comply with regulations for water use and disturbance. The EPA would implement their regulations unless the proposed Project has been delegated to the State of Alaska. The water use limits are set in the Alaska Administrative Code Section 11 AAC 93.035 to determine if any of the water uses are expected to exceed (from each separate requested water source). The AGDC would be required to submit an application for Temporary Use of Water to the appropriate permitting authority and be issued the temporary water use authorization before beginning the requested water use, withdrawal, impoundment, or diversion.

The State of Alaska water quality criteria is contained within the Water Quality Standards (WQS) 18 AAC 70 ADEC (2009) and the Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances in 18 AAC 70.020(b) (ADEC 2008b). These documents constitute the WQSs for a particular waterbody. These standards regulate human activities that result in alterations to waters within the State of Alaska’s jurisdiction (ADEC 2011c). The standards specify the degree of degradation that may not be exceeded in a state waterbody as a result of human actions (ADEC 2010). The criteria includes the fresh WQSs for color; fecal coliform bacteria; dissolved gas; dissolved inorganic substances; petroleum hydrocarbons, oils and grease; pH; radioactivity; residues; sediment; temperature; toxic and other deleterious organic and inorganic substances; and turbidity (Table 5.2-4). The Water Quality Criteria Manual for Toxics contains the numeric water quality criteria adopted into the WQS in 18 AAC 70.020(b). These criteria were taken from the EPA criteria documents cited in the references and Alaska Drinking Water Regulations in 18 AAC 80 (ADEC 2008b).

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Federal		
All Federal Agencies	Executive Order 11990, Protection of Wetlands	The purpose of this Order is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, federal agencies, in planning their actions, are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The Order applies to: acquisition, management, and disposition of federal lands and facilities construction and improvement projects which are undertaken, financed or assisted by federal agencies; and federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
	Executive Order 11988, Floodplain Management	This Order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities" for the following actions: acquiring, managing, and disposing of federal lands and facilities; providing federally-undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
U.S. Environmental Protection Agency (EPA)	Safe Drinking Water Act (SDWA) (42 U.S.C. [United States Code] Section 300 et seq.) – Sole Source Aquifer Protection Program (Section 1424(e))	The SDWA protects drinking water and its sources (i.e., rivers, lakes, reservoirs, springs, and groundwater wells). This does not include private wells supplying fewer than 25 individuals. Any federally funded or partially federally funded projects with the potential to contaminate designated sole source aquifers require an EPA review. Sole source aquifers are defined as supplying at least 50 percent of the drinking water consumed for the area overlying the aquifer.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
U.S. Environmental Protection Agency (EPA)	Section 402, Clean Water Act (CWA) (22 U.S.C. Section 1251 et seq.) – National Pollutant Discharge Elimination System (NPDES): Point Source and Stormwater Discharges	The NPDES program controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either the EPA or an authorized state/tribe contain industry-specific, technology-based and/or water-quality-based limits, and establish pollutant monitoring and reporting requirements. A facility that intends to discharge into the nation's waters must obtain a permit before initiating a discharge. In 1987 the CWA was amended to require the EPA to establish a program to address storm water discharges. In response, the EPA promulgated the NPDES stormwater permit application regulations. Stormwater discharge associated with industrial activity means the discharge from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. These regulations require that facilities with the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which the EPA or the state/tribe determines to contribute to a violation of a water quality standard or which is a significant contributor of pollutants to waters of the United States. Through program delegation, the EPA oversees the ADEC's administration of the Alaska Pollutant Discharge Elimination System (APDES) program that regulates the discharge of pollutants from a point source into waters of the United States for facilities, and construction. Authority for Oil and Gas facilities will be delegated on October 31, 2012. Until authority over a facility transfers to the ADEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
	Section 404, CWA: (33 U.S.C. Section 1251 et seq.) – Discharge of Fill Material to Waters of the U.S.	In 1972, Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States. The Rivers and Harbors Act of 1899 defined navigable waters of the United States as "those waters that are subject to the ebb and flow of the tides and/or are presently used, or have been used in the past, or maybe susceptible to use to transport interstate or foreign commerce." The CWA built on this definition and defined waters of the United States to include tributaries to navigable waters, interstate wetlands, wetlands which could affect interstate or foreign commerce, and wetlands adjacent to other waters of the United States. The program is jointly administered by the U.S. Army Corps of Engineers (USACE) and the EPA. The EPA provides program oversight. The fundamental rationale of the program is that no discharge of dredged or fill material should be permitted if there is a practicable alternative that would be less damaging to aquatic resources or if significant degradation would occur to the nation's waters.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Federal Emergency Management Agency (FEMA)	National Flood Insurance Act of 1968	The U.S. Congress established the National Flood Insurance Program with passage of the National Flood Insurance Act of 1968. The Flood Insurance Program is a pre-disaster flood mitigation and insurance program designed to reduce the exorbitant cost of disasters. It is a voluntary program that provides a *quid pro quo* approach to floodplain management and makes federally backed flood insurance available to residents and business owners in communities that agree to adopt and adhere to sound flood mitigation measures that guide development in their floodplains. FEMA is responsible for administering the National Flood Insurance Program and programs that provide assistance for mitigating future damages from natural hazards. In addition, FEMA is required by statute to identify and map the Nation's flood-prone areas and to establish flood-risk zones in such areas.
U.S. Army Corps of Engineers (USACE)	Section 404, CWA (33 U.S.C. Section 1251 et seq.) – Discharge of Fill Material to Waters of the U.S.	The USACE is responsible for the day-to-day administration and permit review. Permit review and issuance follows a sequence process that encourages avoidance of impacts, followed by minimizing impacts and, finally, requiring compensatory mitigation for unavoidable impacts to the aquatic environment.
U.S. Army Corps of Engineers (USACE)	Section 10 of the Rivers and Harbors Act (33 U.S.C. Section 403) – Navigable Waters of U.S. Dredge and Fill Permit	Section 10 requires authorization from the USACE for the construction of any structure in or over any navigable water of the United States, the excavation/dredging or deposition of material in this water, or any obstruction or alteration in navigable water. Structure or work outside the limits defined for navigable waters of the U.S. requires a permit if the structure or work affects the course, location, condition, or capacity of the waterbody.
U.S. Coast Guard (USCG)	Section 9 of the Rivers and Harbors Act (22 U.S.C. Section 403) – Bridge Permit	Section 9 requires authorization from the USACE to construct any dam or dike in a navigable water of the United States. The construction of bridges and causeways requires permits under Section 9, but the authority to issue permits with respect bridges and causeways was transferred to the USCG in 1966 when the U.S. Department of Transportation was created. However, USACE authorization is required for the discharge of dredged or fill material into waters of the United States associated with dams, dikes, bridges, and causeways under Section 404 of the CWA.
State		
Alaska Department of Environmental Conservation (ADEC)	Temporary Water Use Permit (AS 46.15)	Permit may be issued if the amount of water to be used is significant, the use continues for less than five consecutive years, and the water to be used is not appropriated. A significant amount of water is defined by 11 AAC 93.035(a) and (b) as the consumptive use of more than 5,000 gallons of water from a single source in a single day; the regular daily or recurring consumptive use of more than 500 gpd from a single source for more than 10 days per calendar year; the non-consumptive use of more than 30,000 gpd (0.05 cubic feet per second) from a single source; or any water use that may adversely affect the water rights of other appropriators or the public interest.

TABLE 5.2-3 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Alaska Department of Environmental Conservation (ADEC)	Section 401 of CWA – Section 401 Certification	Pursuant to Section 401 of the CWA the State of Alaska certifies that the project complies with State water quality standards. This is commonly known as the 401 Certification. This review results in conditions placed on either or both the Section 404 permit and Coastal Consistency Determination. The 401 Certification is initiated by the ADEC as part of the 404 permitting process. The ADEC issues the certification of the EPA permits.
	Water Quality Standards, 18 AAC 70	This regulation specifies water quality standards (see Table 5.2-4).
	Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances	This manual contains specific water quality criteria and standard for toxic and other deleterious organic and inorganic substances
	Drinking Water Program, 18 AAC 80	Requires Public Water Systems be in compliance with the state drinking water regulations, in accordance with the Federal Safe Drinking Water Act and Amendments, for the public health protection of the residents and visitors to the State of Alaska
	Alaska Pollutant Discharge Elimination System (APDES): Point Source and Stormwater Discharges	On October 31, 2008, the EPA formally approved the state's NPDES Program application. The state's approved program is called the Alaska Pollutant Discharge Elimination System (APDES) Program. Authority over the federal permitting and compliance and enforcement programs is being transferred to the ADEC over four years. Oil and Gas facilities will be transferred on October 31, 2012. Until authority over a facility transfers to DEC, the EPA will remain the permitting and compliance and enforcement authority for that facility.
Local		
Fairbanks North Star Borough (FNSB)	Flood Management Regulations (FNSB Code Chapter 15.04)	Applies to special flood hazard areas in the Fairbanks North Star Borough that are subject to periodic inundation of floodwaters which can cause loss of life or property, health or safety hazards, the disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the local tax base, all of which adversely affect the public health, safety and welfare.
Matanuska Susitna (Mat-Su) Borough	Flood Plain Development Permit, including both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate (MSB 17.29)	A Flood Plain Development Permit is required before any development within a Federally Designated Flood Hazard Area. A Flood Plain Development Permit (issued by Mat-Su Borough) must include both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate. An Alaska registered Architect or Engineer must certify the Development Permit Application and either a Registered Engineer or Surveyor must complete the elevation certificate
North Slope Borough (NSB)	Coastal Management Plan (NSB Code 19.70.050)	Policies that identify general and specific courses of action to achieve region wide goals and the implementation of incremental activities and organizations for the coastal management program. Subject uses include location and construction of pipelines.

TABLE 5.2-4 Selected State Water Quality Standards (WQS) for Fresh Water

Pollutant	Description	Water Use & Criteria
Temperature	Temperature	Water Supply: drinking, culinary, and food processing – May not exceed 15°C.
		Water Supply: agriculture, including irrigation and stock watering – May not exceed 30°C.
		Water Supply: aquaculture – May not exceed 20°C at any time. (Refer to 18 AAC 70.020(b)(10)(A)(iii) for additional criteria.)
		Water Supply: industrial – May not exceed 25°C.
		Water Recreation: contact recreation – Same as Water Supply: agriculture
		Water Recreation: secondary recreation – Not applicable.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – Same as Water Supply: aquaculture.
Turbidity	An expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample	Water Supply: drinking, culinary, and food processing – May not exceed 5 Nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.
		Water Supply: agriculture, including irrigation and stock watering – May not cause detrimental effects on indicated use.
		Water Supply: aquaculture – May not exceed 25 NTU above natural conditions. For all lake waters, may not exceed 5 NTU above natural conditions.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – May not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. For all lake waters, turbidity may not exceed 5 NTU above natural conditions.
		Water Recreation: secondary recreation – May not exceed 10 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 20% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU. For all lake waters, turbidity may not exceed 5 NTU above natural conditions.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – Same as Water Supply: aquaculture.

TABLE 5.2-4 Selected State Water Quality Standards (WQS) for Fresh Water

Pollutant	Description	Water Use & Criteria
Color	The condition that results in the visual sensations of hue and intensity as measured after turbidity is removed	Water Supply: drinking, culinary, and food processing – May not exceed 15 color units or the natural condition, whichever is greater
		Water Supply: agriculture, including irrigation and stock watering – Not applicable
		Water Supply: aquaculture – May not exceed 50 color units or the natural condition, whichever is greater.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – May not exceed 15 color units or the natural condition, whichever is greater.
		Water Recreation: secondary recreation – May not interfere with or make the water unfit or unsafe for the use.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife - Color or apparent color may not reduce the depth of the compensation for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life. For all waters, without a seasonally established norm for aquatic life, color or apparent color may not exceed 50 color units or the natural condition, whichever is greater.
Dissolved Gas	Dissolved oxygen is the concentration of oxygen in water	Water Supply: drinking, culinary, and food processing – Dissolved Oxygen (D.O.) must be greater than or equal to 4 mg/l (this does not apply to lakes or reservoirs in which supplies are taken from below the thermocline, or to groundwater).
		Water Supply: agriculture, including irrigation and stock watering – D.O. must be greater than 3 mg/l in surface waters.
		Water Supply: aquaculture – D.O. must be greater than 7 mg/l in surface waters. The concentration of dissolved gas may not exceed 110% of saturation at any point of sample collection.
		Water Supply: industrial – May not cause detrimental effects on established water supply treatment levels.
		Water Recreation: contact recreation – D.O. must be greater than or equal to 4 mg/l.
		Water Recreation: secondary recreation – D.O. must be greater than or equal to 4 mg/l.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – D.O. must be greater than 7 mg/l in waters used by anadromous fish. In no case may D.O. be less than 5 mg/l to a depth of 20 cm in the interstitial waters of gravel used by anadromous fish or resident fish for spawning. For waters not used by anadromous or resident fish, D.O. must be greater than or equal to 5 mg/l. In no case may D.O. be greater than 17 mg/l. The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection.

TABLE 5.2-4 Selected State Water Quality Standards (WQS) for Fresh Water

Pollutant	Description	Water Use & Criteria
Dissolved Inorganic Substances	Total dissolved solids (TDS)	Water Supply: drinking, culinary, and food processing – TDS from all sources may not exceed 500 mg/l. Neither chlorides nor sulfates may exceed 250 mg/l.
		Water Supply: agriculture, including irrigation and stock watering – TDS may not exceed 1,000 mg/l. Sodium adsorption ratio must be less than 2.5, sodium percentage less than 60 percent, and residual carbonate less than 1.25 milli-equivalents/liter.
		Water Supply: aquaculture – TDS may not exceed 1,000 mg/l.
		Water Supply: industrial – No amounts above natural conditions that can cause corrosion, scaling, or process problems.
		Water Recreation: contact recreation – Not applicable.
		Water Recreation: secondary recreation – Not applicable.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – same as water supply: aquaculture.
pH	Negative logarithm of the hydrogen-ion concentration	Water Supply: drinking, culinary, and food processing – May not be less than 6.0 or greater than 8.5.
		Water Supply: agriculture, including irrigation and stock watering – May not be less than 5.0 or greater than 9.0.
		Water Supply: aquaculture – May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
		Water Supply: industrial – May not be less than 5.0 or greater than 9.0.
		Water Recreation: contact recreation – May not be less than 6.5 or greater than 8.5. If the natural condition pH is outside this range, substances may not be added that cause an increase in the buffering capacity of the water.
		Water Recreation: secondary recreation Same as Water Supply: industrial.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
Fecal Coliform	Those bacteria that can ferment lactose at 44.5° ± 0.2° C to produce gas in a multiple tube procedure	Water Supply: drinking, culinary, and food processing – In a 30 day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC /100 ml. For groundwater, the FC concentration must be less than 1 FC/100 ml, using the fecal coliform Membrane Filter Technique, or less than 3 FC/100 ml, using the fecal coliform most probable number (MPN) technique.
		Water Supply: agriculture, including irrigation and stock watering – In a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC /100 ml. For products not normally cooked and for dairy

TABLE 5.2-4 Selected State Water Quality Standards (WQS) for Fresh Water

Pollutant	Description	Water Use & Criteria
		sanitation of unpasteurized products, the criteria for drinking water supply apply.
		Water Supply: aquaculture – For products normally cooked, in a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC /100 ml. For products not normally cooked, the criteria for drinking water supply apply.
		Water Supply: industrial – Where a worker contact is present, in a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
		Water Recreation: contact recreation – In a 30 day period, the geometric mean may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC /100 ml.
		Water Recreation: secondary recreation – In a 30 day period, the geometric mean may not exceed 200 FC/100 ml, and not more than 10% of the samples, may exceed 400 FC /100 ml.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – not applicable.
Sediment	Solid material of organic or mineral origin that is transported by, suspended in, or deposited from water	Water Supply: drinking, culinary, and food processing – No measurable increase in concentration of settleable solids above natural conditions, as measured by the volumetric Imhoff cone method.
		Water Supply: agriculture, including irrigation and stock watering – For sprinkler irrigations, water must be free of particles of 0.074 mm or coarser. For irrigation or water spreading, may not exceed 200 mg/l for an extended period of time.
		Water Supply: aquaculture – No imposed loads that will interfere with established water supply treatment levels.
		Water Supply: industrial – Same as water supply: aquaculture.
		Water Recreation: contact recreation – Same as Water Supply: drinking.
		Water Recreation: secondary recreation May not pose hazards to incidental human contact or cause interference with use.
		Growth and propagation of fish, shellfish, other aquatic life, and wildlife – The percent accumulation of fine sediment in the range of 0.1 mm to 4.0 mm in the gravel bed of waters used by anadromous or resident fish for spawning may not be increased by more than 5% by weight above natural conditions (as shown from grain size accumulation graph). (Refer to 18 AAC 70.020(b)(9)(C) for additional criteria.)
Toxics	Strontium-90	Drinking Water – 8 picoCuries per liter (pCi/l)

Sources: ADEC 2008b, 2009.

The WQS for temperature, turbidity, color, dissolved oxygen, pH, dissolved solids, and suspended sediments are the most common data collected. Strontium was selected as an example of a standard from the Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances. Some of the WQS are based on a comparison to natural conditions (for instance “no measureable increase over natural conditions”) or on a comparison to an external criterion (for instance “may not cause detrimental effects on established water supply treatment levels”). In these cases, it is not possible to compare the water quality data to the WQS without more baseline information.

The federal Clean Water Act (CWA) Section 305(b) requires the State of Alaska to monitor and report on surface and groundwater quality of all waterbodies to be characterized; and to list the ones that do not meet WQS under Section 303(d). The ADEC solicits water quality data and information for waterbodies in accordance with EPA guidance (ADEC 2010). The ADEC evaluates the data and information available and assigns each waterbody into one of five categories as follows:

- Category 1. All WQS for all designated uses are attained.
- Category 2. Some WQS for the designated uses are attained, but data and information to determine whether the WQS for the remaining uses are attained are insufficient or absent.
- Category 3. Data or information is insufficient to determine whether the WQS for any designated uses are attained.
- Category 4. The waterbody is determined to be impaired but does not need a total maximum daily load (TMDL). A TMDL is a calculation of the maximum amount of pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant (EPA 2012b).
    - Category 4a. An established and EPA–approved TMDL exists for the impaired water.
    - Category 4b. Requirements from other pollution controls have been identified to meet WQS for the impaired water.
    - Category 4c. Failure to meet a water quality standard for the impaired water not caused by a pollutant; instead the impairment is caused by a source of pollution such as nuisance aquatic plant, degraded habitat, or a dam that affects flow.
- Category 5. WQS for one or more designated uses are not attained and the waterbody requires a TMDL or recovery plan. Category 5 waters are identified on the Section 303(d) list of impaired waters.

The most current data is available in Alaska’s Final 2010 Integrated Water Quality Monitoring and Assessment Report (ADEC 2010), which does not contain groundwater information.

5.2.1.5 Arctic Hydrologic Subregion

The Arctic Hydrologic Subregion includes the area from the Arctic Coastal Plain, the Arctic Foothills to the north side of the Brooks Range ending at Atigun Pass (the continental divide) (TAPS Owners 2001).

The Arctic Hydrologic Subregion has continuous permafrost (Exxon 1982). The surficial geology of the Arctic Coastal Plain consists of coastal deposits of inter-stratified alluvial and marine sediments, as well as local areas of geologic drift. The elevations of the Coastal Plain vary from sea level to about 600 feet. This area is poorly drained due to permafrost and flat terrain, and has many lakes. Low mountains, rolling plateaus, and tundra plains characterize the Arctic Foothills. In the north, the foothills have ridge elevations that range from 600 to 1,200 feet. The foothills consist of undifferentiated glacial and glacio-fluvial deposits. The surficial geology is mostly fine grained quaternary deposits associated with sloping hills. There are few bedrock exposures and few lakes. The Brooks Range is rugged with peak elevations ranging from 6,000 to 8,000 feet. Slope deposits consist of dominantly coarse rubble deposits with a high percentage of bedrock exposure undifferentiated alluvium (Exxon 1982).

The proposed Project area starts at Prudhoe Bay located in the Kuparuk River watershed on the tundra coastal plain. It crosses into the Sagavanirktok (Sag) River watershed and generally follows through the coastal plain to the foothills. In the Arctic foothills, the proposed Project area veers away from the Sag River and crosses through the upper reaches of the Kuparuk River watershed, and then very briefly through the upper reaches of the Lower Colville River watershed[1]. The proposed Project area enters the Brooks Range near Galbraith Lake (headwaters of the Sag River), and continues to Atigun Pass.

Watershed Characteristics

The proposed Project area in the Arctic Hydrologic Subregion consists of the Sag River watershed and Kuparuk River watershed. The proposed Project ROW is located primarily in the Sag River watershed, with small areas extending into the Kuparuk River watershed, as shown in Figure 5.2-1. The watersheds contain numerous ponds, lakes, and streams. Ponds include flooded tundra ponds, shallow and deep water ponds with varying depths and presence and type of aquatic vegetation (Truett and Johnson 2000). Lakes found on the coastal plain vary in depth where they are shallowest near the coast and get deeper near the foothills of the Brooks Range (Truett and Johnson 2000). Three lake types have been described by Bendock and Burr (1985), as oxbow, thaw and deflation; and five lake types by Moulton and George (2000): tapped, low perched, high perched, drainage and tundra lakes. The lakes were classified by origin under Bendock and Burr (1985) and by fish access by Moulton and George (2000).

Three main types of streams occur in the subregion: mountain streams, spring streams, and tundra streams (Truett and Johnson 2000). Mountain streams are the streams that originate from the Brooks Range, and include braided and interconnected channels. Spring streams are spring fed tributaries that feed upper reaches of mountain streams and are not present in the coastal plain. Tundra streams drain the Brooks Range, foothills and coastal plain. Beaded

[1] The portion in the Lower Colville River watershed is so small that it is not discussed as part of the study area.

streams are tundra streams characteristic of permafrost underlain areas which are small pools or ponds linked by stream channels (Truett and Johnson 2000).

Sagavanirktok River Watershed (HUC 19060402-5,279.63 sq. miles)

The Sag River originates in the Brooks Range, and its headwaters are characterized by steep slopes and stream channel braiding from high velocity flows. The gradient decreases northbound from the Arctic Foothills to the Coastal Plain towards the Beaufort Sea, causing deposition of sediments and the formation of alluvial fans (BP 1995, p 4-11 and 4-13). Besides the Sag River, the watershed contains numerous ponds, lakes, and streams as noted and described above.

Kuparuk River Watershed (HUC 19060401-4,295.93 sq. miles)

The Kuparuk River watershed characteristics are similar to the Sag River watershed in that the Kuparuk River has split channels and drains the Brooks Range foothills and coastal plain areas. The landscape that both rivers flow through is parallel to each other, and has similar geomorphology. The Kuparuk River, however, is considered a tundra stream due to drainage of tundra covered slopes (surface water) (Truett and Johnson 2000). The Sag River receives water from both surface runoff (tundra) and perennial springs (groundwater) which results in different water chemistry versus the Kuparuk River.

Surface Water

Surface Water Availability

As mentioned previously, the state of Alaska has an abundance of surface water. According to the ADNR, very little data has been collected on this resource on a state-wide basis. The rivers and streams that cross the proposed Project area are shown in Appendix E arranged from north to south. Appendix F shows the location, surface area, and type of lake or pond located within 1 mile of either side of the proposed Project ROW in the Arctic Hydrologic Subregion.

Additional lake and pond characteristic data is available for selected lakes in the Arctic Hydrologic Subregion. Forty-four preselected lakes were chosen to survey for water withdrawal uses based on proximity to the proposed Project area and presumed size and depth. Lake area and depth were collected for 32 of the preselected lakes (Table 5.2-5). Maximum withdrawal limits for sampled lakes located between the GCF and Galbraith Lake. See Section 5.6, Fish Table 5.6-1 and Figure 5.6-1 for additional characteristics of selected lakes within the Arctic Hydrological Subregion.

TABLE 5.2-5 Summary of Surface Area (square feet)and Maximum Depth (feet) for Lakes sampled in the Arctic Hydrologic Subregion

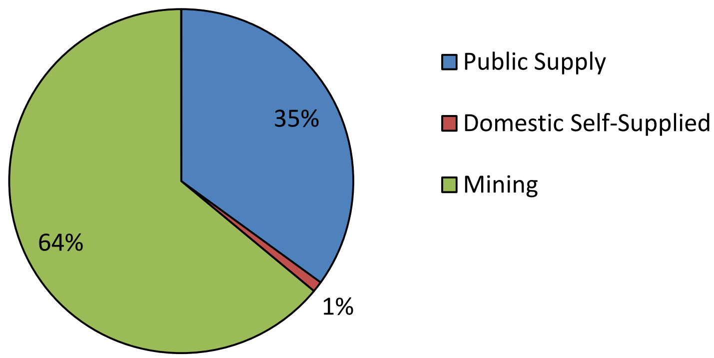
Lake Name	Surface Area (square feet)	Max. Depth (feet)
DNR001	240.28	-4.00
DNR002	431.52	NA
DNR003	269.84	-2.75
DNR004	536.71	-6.00
DNR005	137.38	-10.50
DNR006	28.93	-8.50
DNR007	46.75	-7.25
DNR009	181.39	-3.75
DNR013	62.18	-4.75
DNR016	259.82	-7.75
DNR019	120.25	-5.25
DNR020	15.94	-12.00
DNR021	37.56	-3.50
DNR022	28.71	-6.75
DNR024	33.13	-20.00
DNR025	67.02	-8.25
DNR028	67.00	-37.00
DNR029	56.50	-20.00
DNR030	17.52	-10.50
DNR031	20.85	-13.50
DNR033	17.91	-9.50
DNR034	8.00	-24.00
DNR035	13.88	-64.00
DNR036	27.06	-44.00
DNR037	20.84	-9.50
DNR038	19.86	-23.00
DNR039	22.63	-64.00
DNR040	87.80	-55.00
DNR042	15.19	-27.00
DNR044	10.51	-43.00
DNR045	44.89	-26.00
Galbraith Lake	NA	NA

Source: AGDC 2011a.

NA= Not Available

Surface Water Use

As previously mentioned, surface water use data is available by borough or census area. Borough and census area boundaries are shown in gray on Figure 5.2-3. The surface water use for the North Slope Borough is shown in Table 5.2-1. As shown in Figure 5.2-4, the 2005 estimated fresh surface water use for the North Slope Borough was 64 percent for mining, and 35 percent for public supply. Domestic self supplied water accounts for 1 percent of the surface water use.



Source: USGS 2010b.

FIGURE 5.2-4 2005 Fresh Surface Water Use (Percent) for the North Slope Borough

Surface Water Quality

The Arctic Hydrologic Subregion has no PWS' with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are located within the proposed Project area ROW. The proposed Project area in both the Kuparuk and Sag River watersheds generally follows the existing TAPS ROW. For the Kuparuk River watershed, one site (Ku-S1) was found that met the criteria listed in Section 5.2.1. Data was collected at Site Ku-S1 in 1986. The Sag River watershed also had only one site (Sag-S4) that met the selection criteria described in Section 5.2.1. The data for Sag-S4 was collected in 1979 (post 1977), after the TAPS project was completed.

Although there has been localized population growth in certain areas of the Kuparuk and Sag River watersheds since this data was collected, there has not been any major population growth or other major construction projects near these sites. Although Ku-S1 is 10 miles from the proposed Project area, the land use activity is likely similar (barring a potential oil spill) to the majority of the proposed Project area in the Kuparuk River watershed. The Sag-S4 site is within ½ mile of the proposed Project area, and is likely representative of present surface water quality for the majority of the watershed (except where population growth has occurred near Prudhoe Bay).

The data from Ku-S1 indicates that the fresh surface water in the Kuparuk River watershed met state WQSs for temperature, turbidity, dissolved oxygen, pH, fecal coliform, total dissolved solids, and suspended sediment (Table 5.2-6). The data from Sag-S4 shows that the fresh surface water in the Sag River watershed met WQS for temperature and pH. Note that a given sampling site may have data for other WQS or criteria (for example, sulfate, nitrates, or iron), but only data for the selected WQS and criteria are shown. The Ku-S1 site and Sag-S4 sites are far apart; therefore, pre-1977 data is included in Table 5.2-6 for additional sites Sag-S1, Sag-S2, and Sag-S3. The data in Table 5.2-6 illustrates water quality sampled at five locations over an 11 year period within two watersheds (Kuparuk and Sag). These results would likely be highly variable and not a true analysis of the actual water quality of the watersheds due to infrequent sampling at separate locations. The variability of the results would be dependent on when the sample was taken (seasonal changes), and changes due to the sampling location. Additional water quality sampling would be required to obtain a true and accurate assessment of water quality in the Kuparuk and Sag watersheds.

Water quality studies were conducted by UAF (WERC) between 2005 and 2007 in six lakes over a few months each year in the Kuparuk Watershed. These studies illustrated some general water quality results for tundra lakes. Blackburn et al. (2007) stated that dissolved oxygen concentration declined from December to March, and was higher near the water's surface than measurements taken at the bottom of the lake. The pH levels were higher in December versus February but were lower near the water's surface for all months. Electrical conductance (µS/cm) was similar across all months sampled (December to April) and higher at the water's surface.

Table 5.2-7 indicates the ADEC's classification of waterbodies in the Arctic Hydrologic Subregion. There are no waterbodies listed in Category 5, which includes impaired waters identified under Section 303(d) of the CWA. Most of the waterbodies remain unclassified, but it is expected that they would fall under Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

Additional water chemistry data is available for selected lakes in the Arctic Hydrologic Subregion. The AGDC preselected 44 lakes to survey based on the proximity to the proposed Project area and presumed size and depth. Water chemistry data were collected for 32 of the preselected lakes in July of 2010, and 30 of these lakes were measured for depth. This data is shown in Table 5.2-8, and their location is shown on Figure 5.6-2 in Section 5.6, Fish.

TABLE 5.2-6 Summary of Surface Water Quality – Arctic Hydrologic Subregion

Watershed and Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium **(µg/L)**	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Kuparuk River (19060401)											
15896000	Ku-S1	8/21/1986	7.4	0.60	--	12.7	6.9	39.0	0.0	54	8
Sag River (19060402)											
694943148451300	Sag-S1	9/21/1975	0.5	--	3	14.3	7.6	--	--	133	--
692200148433000	Sag-S2	5/2/1975	0.0	--	5	--	8.0	--	--	563	--
15910200	Sag-S3	9/16/1975	2.5	--	--	--	--	--	--	--	--
15904900	Sag-S4	5/23/1979	6.5	--	--	--	7.8	--	--	--	--

°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available
Representative data sites are bolded, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c. (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

TABLE 5.2-7 ADEC Waterbody Classification – Arctic Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Kuparuk River	0	0	Kuparuk River	0	0
Sag River	0	Sag River to Simpson Lagoon	Colleen Lake, Lake McDermott, and Sag River	0	0

Source: ADEC 2010.

TABLE 5.2-8 Summary of Water Quality Data for 32 Lakes in the Arctic Hydrologic Subregion

Lake Name	Sample Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH metered	pH Litmus Paper	Color of Water Observed
DNR001	7/8/2010	15	13.05	380		7.6	6.5	Hummic Muddy
DNR002	7/9/2010	16	0.29	244		7.8		Muddy
DNR003	7/9/2010	14	12.43	296	0.18	7.4		Muddy
DNR004	7/9/2010	18	11.67	327	0.18	7.5		Clear
DNR005	7/9/2010	15	14.8	191		8.6		unk
DNR006	7/10/2010	14	13.4	147		7.8		Clear
DNR007	7/10/2010	14	11.82	142	0.09	7.8		Hummic
DNR009	7/11/2010	12	10.11	183	0.11	6.8		unk
DNR013	7/12/2010	15	10.84	159	0.09	7.6		Clear
DNR016	7/12/2010	14	20.6	90	0.05	6.9		Hummic
DNR019	7/13/2010	14	12.38	114	0.07	6.8		Hummic
DNR020	7/17/2010	14	11.2	51		6.9		Muddy
DNR021	7/17/2010	14	11.72	3	0	6.8		Muddy
DNR022	7/13/2010	13	10.81	29	0.02	6.1		Hummic
DNR024	7/14/2010	16	10.54	44	0.01	7.3		Clear
DNR025	7/14/2010	13	16	27		6.3		Muddy
DNR028	7/15/2010	14	20	62		7.1		Clear
DNR029	7/17/2010	14	20.26	46	0.03	6.4		Clear
DNR030	7/14/2010	13	11.07	25	0.01	6.9		Muddy
DNR031	7/13/2010	13	9.58	101	0.06	6.5		Hummic
DNR033	7/14/2010	16	10.68	133	0.08	6.6		Hummic
DNR034	7/16/2010	13	10.78	84	0.05	7.1		Hummic

TABLE 5.2-8 Summary of Water Quality Data for 32 Lakes in the Arctic Hydrologic Subregion

Lake Name	Sample Date	Water Temperature (degrees C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH metered	pH Litmus Paper	Color of Water Observed
DNR035	7/16/2010	13	15.4	113	0.07	7.1		Clear
DNR036	7/15/2010	12	11.71	10	0.01	6.5		Clear
DNR037	7/15/2010	11	11.52	18	0.01	5.8		Hummic
DNR038	7/16/2010	14	13.4	20	0.01	6.9		Clear
DNR039	7/17/2010	13	10.53	19	0.01	5.9		Clear
DNR040	7/16/2010	11	9.61	25	0.02	5.9		Hummic
DNR042	7/17/2010	12	10.81	146	0.09	7.3		Hummic
DNR044	7/16/2010	13	11.37	194	0.12	8.1		Clear
DNR045	7/16/2010	7	12.47	78	0.05	7.1		Hummic
Galbraith	7/16/2010	12	9.91	138	0.09	7.1		Clear

Source: AGDC 2011c.

unk = unknown value

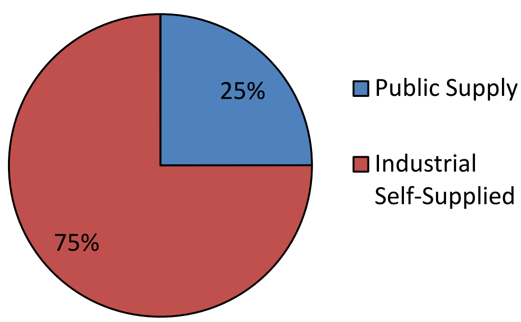
Groundwater

Groundwater Availability

Groundwater availability is limited in the Arctic Hydrologic Subregion due to permafrost; however, groundwater occurs above, below and locally within permafrost (Williams 2007). At temperatures ranging from 32 to 40 degrees Fahrenheit, groundwater is more viscous and moves more slowly than in temperate regions (Williams 2007). Table 5.2-9 presents data on private wells in the Arctic Hydrologic Subregion from WELTS (ADNR 2011).

Groundwater Use

As with surface water, for the purpose of the affected environment, the water use for the Arctic Hydrologic Subregion is reflected by the North Slope Borough groundwater use provided in Table 5.2-2. As shown in Figure 5.2-5, the 2005 estimate for fresh groundwater use for the North Slope Borough was 75 percent industrial self-supplied and 25 percent public supply.



Source: USGS 2010b.

FIGURE 5.2-5 2005 Estimated Fresh Groundwater Use (Percent) for the North Slope Borough

Groundwater Quality

The Arctic Hydrologic Subregion does not have PWSs with groundwater as the primary source listed on the EPA's SNC List (ADEC 2011b). Water is brackish or saline in bedrock beneath permafrost in much of the continuous permafrost zone draining to the Arctic Ocean, although fresh water is discharged from springs along faults bounding the limestone of the Lisburne Group of the Brooks Range (Williams 2007). Little information exists on the quality of groundwater from permafrost and low temperatures. The restricted circulation of groundwater may result in higher concentrations of dissolved solids (Williams 2007). The surface water and groundwater monitoring sites maps presented in Appendix G illustrate the locations of selected USGS groundwater quality sampling sites relative to the proposed Project area.

TABLE 5.2-9 Well Data from WELTS – Arctic Hydrologic Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (Ft. below GL)	Static H2O Level (Ft. below GL)	Flow Rate (GPM)	Date Well Completed
Umiat	15	29	19	1	Arctic Village	200	unk	unk	4/27/1967
Umiat	15	2	17	1	Anaktuvuk Pass (B9 Well 1)	147	13.6	100	6/26/1994
Umiat	15	2	17	1	Anaktuvuk Pass (B9 Well 2)	138	15.3	6	6/28/1994
Umiat	7	14	9	1	TAPS (03 PW-1, Pipe M104)	30	3.0	40	9/02/1983
Umiat	7	14	9	1	TAPS (03 PW-2, Pipe M104)	39	5.4	unk	5/13/1990
Umiat	7	14	9	1	TAPS (03 PW-2, Pipe M104) near Oksrukuyik	37	5.0	unk	11/21/1992
Umiat	12	12	8	1	TAPS 04 (Pipe M144) near Atigun River	171	143	unk	10/26/1978
Umiat	7	14	16	1	TAPS Pump Station 03 (PW-3)	40	5.5	4.5	5/12/1990
Umiat	9	11	29	1	Dalton HWY (Toolik Lake Research Station)	117	72	35	5/31/2006

Source: ADNR 2011.
unk = unknown value

No USGS groundwater quality sites with water quality data were found in the Arctic Hydrologic Subregion of the proposed Project area. The closest USGS groundwater sampling site in the Arctic Hydrologic Subregion was located in the Northwest Coast Hydrologic Unit. This site is about 197 miles away from the proposed Project area; therefore, is not considered representative and is not included in this analysis.

Floodplains

The Sag River floodplain spans 4 miles wide in its northern most reaches before it feeds the Beaufort Sea (BLM 2002). It is characterized by a meandering river that becomes braided due to low discharge from the flat Arctic Coastal terrain (BLM 2002). Other smaller streams in the Arctic Subregion drain thermokarst[2] lakes. The Sag River floodplain possess characteristic tundra ponds, lakes and streams as discussed in the watershed characteristics section noted above.

Peak surface water flows usually occur in July and August. There is minimal stream flow during the winter, which can result in aufeis[3] formation. Maximum water levels often occur during spring runoff from snow melt, and from aufeis which can back up stream flow (BLM 2002). Permafrost allows little surface water storage capacity in the watershed resulting in peak pulse flows which tend to increase and decrease rapidly (BLM 2002). The rivers experience high erosion in the summer, due to flooding when the streambed and banks thaw (BP 1995).

The proposed Project area for the Sag River floodplain is located entirely in the North Slope Borough, and there are no available FEMA floodplain maps for the borough (FEMA 2011). However, flooding is identified as a hazard with a moderate probability of occurrence in the North Slope Borough (NSB 2005). The Arctic Coastal Plain is known for its cold and desert-like conditions with precipitation ranging between 5 and 7 inches, which are primarily in the form of snow (Truett and Johnson 2000). In the North Slope Borough, flooding can be caused by runoff events, snow melt floods, groundwater flooding, ice jam floods, flash floods, fluctuating lake levels, alluvial fan floods, and glacial outburst floods (depending on the topography, location and bodies of water, streams or rivers). For the North Slope Borough as a whole, the risk of a flood from runoff events, snowmelt, ice jams, flash floods, and alluvial fan floods are categorized as "low level" hazards. Groundwater flooding is possible, but risk is minimized by construction of elevated structures. The risk of lake level fluctuation is little or none (NSB 2005). Specific communities (for instance Barrow and Anaktuvuk Pass) are identified as potentially subject to floods, but the Sag and Kuparuk rivers are not mentioned (NSB 2005).

There are five USGS stream gauge stations on the Sag River with peak stream flow data near the proposed Project area. Table 5.2-10 summarizes the period of data number of years on record, minimum and maximum known water elevation above sea level, the mean peak stream flow by cubic feet per second (cfs). The high water mark (maximum water stage) represents from 11 to 34 years of data, but probably do not reflect a 100-year flood (a flood that has a 1 percent chance of occurring in any year).

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[2] A thermokarst is a "lake formed in a depression by the thawing of ground ice in soil above permafrost" (BLM 2002).
[3] Aufeis forms when low flow (often groundwater) freezes in layers over frozen ground.

TABLE 5.2-10 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds Near the Proposed Project – Arctic Hydrologic Subregion

Watershed and USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Kuparuk River (19060401)						
15896000	Kuparkuk R near Deadhorse	1971-2011	41	32.12 (1999)	37.60 (1978)	49,320
Sag River (19060402)						
15910300	Sag River Trib near Happy Valley Camp	1997-2011	15	928 (2006)	974 (2000)	405
15910000	Sag River River near Sagwon	1969-1979	11	986 (1975)	1018 (1969)	21,130
15908000	Sag River near Pump Station 3	1983-2011	29	1,133 (1988)	1,173[b,c] (2000)	19,295
15904900	Atigun River Tributary near Pump Station 4	1976-2009	36	2,777 (2006)	2806 (1999)	648
15904800	Atigun River near Pump Station 4	1992-2008	12	3,134 (1992)	3175 (2003)	502

[a] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.

[b] Gauge height affected by backwater.

[c] Gauge height not the maximum for the year.

Source: USGS 2010e. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

5.2.1.6 Interior-Yukon Hydrologic Subregion

This hydrologic subregion consists of the Yukon River Drainage which flows into the Bering Sea. The region includes the south side of the Brooks Range, the Yukon-Tanana Uplands, the Tanana River Valley, and the north side of the Alaska Range (TAPS Owners 2001). Similar to the north side of the Brooks Range, the south side of the Brooks Range is rugged with continuous permafrost. Slopes are steep through the lower reaches of the Dietrich River, where valleys widen and become U-shaped. The Dietrich River floodplain is wide and braided. The Yukon–Tanana Uplands consist of rounded hills and ridges at elevations of 2,000 to 4,000 feet. The Tanana River Valley is a wide, lowland depression, with discontinuous permafrost. The north side of the Alaska Range rises to peaks of 6,000 to 9,000 feet. The Alaska Range has discontinuous permafrost (TAPS Owners 2001).

Watershed Characteristics

The proposed Project area includes the Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, Yukon Flats, Tolovana River, Lower Tanana River, Nenana River, and Tanana Flats Watersheds[4] (Figure 5.2-1).

Upper Koyukuk River Watershed – HUC 19040601 (6,927.10 sq. miles)

The Dietrich River originates in the Brooks Range near Atigun Pass. The Dietrich River flows south to join the Middle Fork Koyukuk. The South Fork Koyukuk joins the Middle Fork Koyukuk and becomes the Upper Koyukuk west of the proposed Project (southwest of Bettles). The Upper Koyukuk River flows west to join the Yukon River. The towns of Wiseman and Bettles are located within this watershed. The proposed Project area crosses the Middle Fork Koyukuk River in this watershed.

South Fork Koyukuk River Watershed – HUC 19040602 (2,313.29 sq. miles)

The South Fork of the Koyukuk originates in the foothills of the south side of the Brooks Range, at Twin Lakes just east of Wiseman. The South Fork of the Koyukuk flows west to join the Middle Koyukuk and eventually the Yukon River well west of the proposed Project. The proposed Project area crosses the South Fork Koyukuk River in this watershed.

Kanuti River Watershed – HUC 19040604 (3,353.66 sq. miles)

The Kanuti River flows west to join the Koyokuk and then the Yukon River west of the proposed Project area. Only a small portion of proposed Project area crosses through upper reaches of this watershed. The proposed Project area crosses the Kanuti River in this watershed.

Yukon Flats Watershed – HUC 19040403 (7,479.09 sq. miles)

The southwest corner of the Yukon Flats watershed is briefly crossed by the proposed Project. This watershed will not be discussed in detail further due to the small area proposed for use by the proposed Project.

Ramparts Watershed – HUC 19040404 (3,106 sq. miles)

This watershed includes the Yukon River from east of Stevens Village to west of Rampart. The terrain is not as steep as the Brooks or Alaska Range. The proposed Project area crosses the Yukon River in this watershed.

Tolovana River Watershed – HUC 19040509 3,361.59 sq. miles)

The Tolovana River originates outside of the Minto Flats Game Refuge near Minto, and flows south to join the Tanana River, which flows west and north to the Yukon River well west of the proposed Project area. The proposed Project area crosses the Tolovana River in this watershed.

[4] The proposed Project area also briefly crosses headwaters of the Middle Fork-North Fork Chandalar River, Yukon Flats, and Chena River (Fairbanks Lateral) watersheds. Because so brief, these watersheds are not considered part of the study area.

Lower Tanana River Watershed HUC 19040511 (4,684.76 sq. miles)

A small portion of the proposed Project area crosses the very upper reaches of this watershed. The proposed Project area crosses the Tanana River.

Tanana Flats Watershed – HUC 19040507 4,470.87 sq. miles)

The watershed includes the Tanana River from about the village of Tanana to Nenana. Many watersheds contribute to the Tanana Flats watershed. The proposed Project area crosses this watershed on the western most edge of the watershed near Nenana. Portions of the watershed are in the Alaska Range.

Nenana River Watershed – HUC 19040508 (3,896.17 sq. miles)

The Nenana River originates in the Alaska Range in Denali National Park. It flows west, then north along the highway (and proposed Project area) starting at Cantwell then through McKinley Village, Lignite, Healy and Anderson. It joins the Tanana River at Nenana. The proposed Project area crosses the Nenana River.

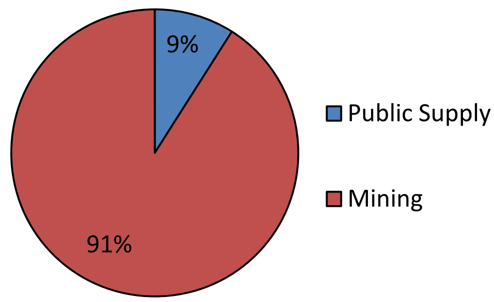
Surface Water

Surface Water Availability

The rivers and streams that cross the proposed Project area are shown in Appendix E arranged from north to south. Appendix F shows the location, surface area, and type of lake or pond located within 1 mile on either side of the proposed Project ROW in the Interior-Yukon Hydrologic Subregion.

Surface Water Use

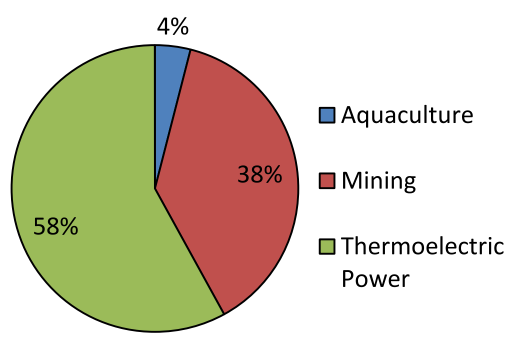
Borough and census area boundaries are shown in Figure 5.2-3 and Appendix G. Unlike the Arctic Hydrologic Subregion, the proposed Project area in the Interior-Yukon Hydrologic Subregion crosses through several different boroughs and census areas. The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River watersheds are all within the Yukon-Koyukuk Census Area. Based on data provided previously in Table 5.2-1, the 2005 estimated surface water use is primarily for mining (91 percent) with the remaining 9 percent for PWS as shown in Figure 5.2-6.



Source: USGS 2010b.

FIGURE 5.2-6 2005 Estimated Fresh Surface Water Use (Percent) for the Yukon-Koyukuk Borough

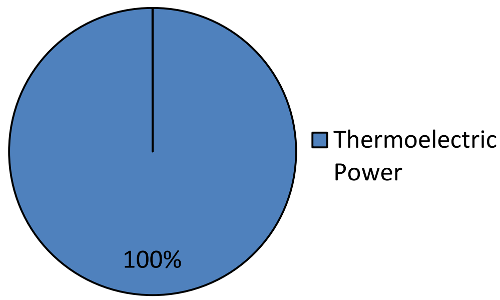
The Tolovana River Watershed is situated half in the Yukon-Koyokuk Census Area and half in the Fairbanks North Star Borough. Water use in the Fairbanks North Star Borough is much greater than the total water use in the Yukon-Koyukuk River watershed; therefore, the average water use for the Tolovana River Watershed would be represented by the Fairbanks North Star Borough water use estimates. The Tanana Flats Watershed is also represented by the Fairbanks North Star Borough estimates. As shown in Figure 5.2-7, over half (58 percent) of the water use for these watersheds is for thermoelectric power, and just over a third (38 percent) for mining. A small portion (4 percent) is used for aquaculture.



Source: USGS 2010b.

FIGURE 5.2-7 2005 Estimated Fresh Surface Water Use (Percent)

The Nenana River Watershed is located in the Denali Borough. As shown in Figure 5.2-8, the surface water use in this watershed is exclusively for thermoelectric power.



Source: USGS 2010b.

FIGURE 5.2-8 Nenana River Watershed – 2005 Estimated Fresh Surface Water Use (Percent)

Surface Water Quality

The Interior-Yukon Hydrologic Subregion has no PWSs with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are within the proposed Project area footprint (Appendix G). The proposed Project area that crosses the Upper Koyukuk, South Fork Koyukuk, Kanuti, Ramparts, and part of the Tolovana watersheds generally follows the existing TAPS ROW. The following brief discussions for water quality criteria in each watershed within the Interior Yukon Hydrologic Subregion are included in Table 5.2-11.

The Upper Koyukuk River watershed had one site (UK-S2) that met the selection criteria listed in Section 5.2.1, this data was collected in 1978. There has not been any major population growth or other major construction projects in the watershed since the data was collected, and the site is very close to the proposed Project area; therefore, it is reasonable to assume the data is representative of current surface water quality in the proposed Project area. Based on this data, the fresh surface water in the Upper Koyukuk River watershed met the WQS for temperature and pH for all water uses. Table 5.2-11 includes two sites (UK-S1 and UK-S3) with data collected before 1977, which may not be representative because the TAPS was built in 1977.

The South Fork Koyukuk River and Kanuti River watersheds had no sites that met the selection criteria listed in Section 5.2.1. Table 5.2-11 includes one site (SFK-S1) with data collected in 1975, and (Ka-S1) with data collected in 1972 which may not be representative of current water quality because the TAPS was built in 1977.

The Ramparts watershed had one site (Ra-S1) that met the selection criteria listed in Section 5.2.1, this data was collected in 2005. There has not been any major population growth

TABLE 5.2-11 Summary of Surface Water Quality from USGS Stream Gauge Sites – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium **(µg/L)**	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Upper Koyukuk River (19040601)											
675538149511100	UK-S1	3/15/1972	1.5	--	--	11.6	7.9	--	--	--	--
15564875	UK-S2	3/16/1978	2.0	--	--	--	7.3	--	--	--	--
671546150121600	UK-S3	6/20/1972	8.0	--	10	10.4	8.4	--	--	116	--
South Fork Koyukuk (19040602)											
15564887	SFK-S1	5/18/1975	0.0	--	--	--	<5.5	--	--	--	--
Kanuti River (19040604)											
662603150380700	Ka-S1	3/14/1972	0.0	--	5	7.8	7.2	--	--	82	--
Ramparts (19040404)											
15453500	Ra-S1	8/22/2005	13.4	--	--	11.6	7.9	148	--	140	616
Tolovana (19040509)											
652753148374900	To-S1	3/14/1972	0.5	--	20	0.4	7.6	--	--	184	--
Lower Tanana (19040511)											
N/A – see TF-S1											
Nenana River (19040508)											
15518250	Ne-S1	8/25/1972	11.5	--	130	--	7.0	--	--	48	--
15518040	Ne-S2	7/31/1991	7.3	85	80	11.0	7.8	170	--	148	--
15516200	Ne-S3	9/27/1972	1.0	--	0.0	--	7.6	--	--	95	--
Tanana Flats (19040507)											
15515500	TF-S1	8/30/2005	10.9	--	--	10.7	7.9	182	--	E 167	1090

°C = degrees Celsius; NTU = nephelometric turbidity units; Pt-Co = Platinum Cobalt units mg/L = milligrams per liter; pH = measure of the acidity or alkalinity of a solution s.u. = standard units µg/L = micrograms/liter E means estimated, N/A means not available
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c (Disclaimer: The data from the USGS NWISWeb database may include data that have not received Directors approval and is provisional and subject to revision.)

or other major construction projects in the watershed since the data was collected, and the site is close to the proposed Project area; therefore, it is reasonable to assume the data is representative of current surface water quality in the proposed Project area. Based on this data, the fresh surface water in the Ramparts watershed met WQS for temperature, dissolved oxygen, pH, and total dissolved solids for all water uses. However, it may not meet the suspended sediment criteria for one or more water uses.

The Tolovana River watershed had no sites that met the selection criteria listed in Section 5.2.1. One site (To-S1) near the TAPS had data collected in 1972, which may not be representative because TAPS was built in 1977. Note that Goldstream Creek in the Tolovana watershed is on the ADEC list for impaired waters, as shown in Table 5.2-11. No data from sample sites were available near the proposed Project area in the Lower Tanana River watershed.

The Nenana River watershed includes three sites (Ne-S1, Ne-S2, and Ne-S3) that met the selection criteria listed in Section 5.2.1, and this data was collected in 1972, 1991, and 1972 respectively. The proposed Project area is not adjacent to the TAPS ROW in this watershed. Although it is not associated with the TAPS, there has been population growth in this corridor since 1972, the 1991 data collected at Ne-S2 is potentially the only representative data. Based on the data from Ne-S2, the fresh surface water in the Nenana River watershed met the WQS for temperature, dissolved oxygen, pH, and total dissolved solids for all water uses, but it did not meet the WQS for turbidity or color for at least some water uses (Table 5.2-11).

The Tanana Flats watershed had one site (TF-S1) that met the selection criteria and the data was collected in 2005. The land use has not changed significantly since this time; therefore, it is likely representative of current conditions. This data shows that the surface water quality met WQS for temperature, dissolved oxygen, pH, and dissolved solids for all water uses near the proposed Project area. However, the level of suspended sediment may exceed the WQS for at least some water uses (Table 5.2-11). The data in Table 5.2-11 illustrates water quality sampled at 11 locations over a 33 year period within 8 watersheds. The infrequent historical sampling at these sites would not adequately portray the actual water quality in these watersheds. The variability of the results would be dependent on when the sample was taken (seasonal changes), years apart and changes due to the sampling location. Additional water quality sampling would be required to obtain a true and accurate assessment of water quality in these interior watersheds. Sampling the water chemistry and quality seasonally throughout a full year would provide more detailed characterization of the surface water by drainage.

Table 5.2-12 illustrates the ADEC's classification of waterbodies in the Interior-Yukon Hydrologic Subregion. There is one waterbody in Category 5, which lists impaired waters identified under Section 303(d) of the CWA. Most of the waterbodies remain unclassified, but it is likely that they would be placed in Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

Goldstream Creek in the Tolovana River Watershed is listed in Category 5 as impaired by the ADEC as described below. Large volumes of fine sediment have been deposited in Goldstream Creek over time since the 1900s due to hydraulic stripping and dredging from placer gold mining in the Goldstream Valley (ADFG 1987). As a result, Goldstream Creek has a constant elevated level of turbidity and total suspended solids (TSS).

TABLE 5.2-12 ADEC Waterbody Classification – Interior-Yukon Hydrologic Subregion

Watershed	Category 1 Unclassified	Category 2	Category 3	Category 4	Category 5 (Section 303(d)) Impaired
Upper Koyukuk River	0	0	0	0	0
South Fork Koyukuk River	0	0	0	0	0
Kanuti River	0	0	0	0	0
Ramparts	0	0	Minook Creek	0	0
Tolovana River	0	0	Chatanika River	0	Goldstream Creek
Lower Tanana River	0	0	0	0	0
Nenana River	0	0	Lignite Creek	0	0
Tanana Flats	0	0	Bear Creek Birch Lake McDonald Creek Pile Driver Slough Quartz Lake Shaw Creek	0	0

Source: ADEC 2010.

Groundwater

Groundwater Availability

Groundwater is available in the Interior-Yukon Hydrologic Subregion because permafrost is not continuous. Table 5.2-13 presents WELTS data on private wells in the Interior-Yukon Hydrologic Subregion.

Groundwater Use

The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River watersheds are all located entirely within the Yukon-Koyukuk Census Area. Based on data provided previously in Table 5.2-2, the groundwater use is (85 percent) public supply, with 10 percent and 5 percent used for domestic self-supplied and industrial self-supplied respectively (Figure 5.2-9).

TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Umiat	7S	14E	3	1	DENALI NATIONAL PARK HOTEL & RILEY CREEK & TOKLAT CAMPS	404, 158, 130	UNKNOWN	UNKNOWN	1963
Umiat	7S	14E	25	10	R23B&C (Various)	74 - 141	37 - 99	5 - 55	1982 - 2006
Fairbanks	29N	12W	1	1	R7 (SOUTH OF CLEAR, AK - 388 PIT (M388 OF RAILROAD?))	180	110	50	4/16/1998
Fairbanks	19N	4W	19	2		420, 180	6, 2	10, 8	1974
Fairbanks	13N	11W	36	2	R7 (MCKINLEY CREEKSIDE CABINS)	97 , 120	42, 55	70, 100	2003, 2005
Fairbanks	1N	1W	35	1	DENALI GRIZZLY BEAR PARK 3	165	82	19.5	4/26/1993
Fairbanks	1N	1W	36	9	8 in R7, 1 in R10	47 - 440	40 - 258	2 - 300	1983 - 2004
Fairbanks	1N	2W	5	1	MCKINLEY VILLAGE, DENALI HOMESTEAD L5B	190	135	20	6/23/2001
Fairbanks	1N	2W	6	15	14 in R7, 1 in R8	180 - 440	38 - 228	3 - 20	1983 - 2003
Fairbanks	1N	2W	7	35	R10 (Spinach Creek, Frenchman Dr., Foxfire Subd.)	150 - 400	45 - 268	0.5 - 18	1974 - 2000
Fairbanks	1N	3W	8	4	R10 (Various)	59 - 247	8 - 180	10 - 15	1954 - 1982
Fairbanks	4S	8W	7	6	Region 7	180 - 394	90 - 170	2.5 - 30	1983 - 1997
Fairbanks	8S	9W	16	1	R10 (TL1607, TRILBY AVENUE)	233	83	4-5	4/19/2001
Fairbanks	8S	9W	18	2	PARKS HIGHWAY M227.2 & M227.4	249, 158	195, 115	30, 25	11/3&6/98
Fairbanks	8S	9W	21	2	R10 (Fairbanks)	164, 252	UNKNOWN	UNKNOWN	UNKNOWN

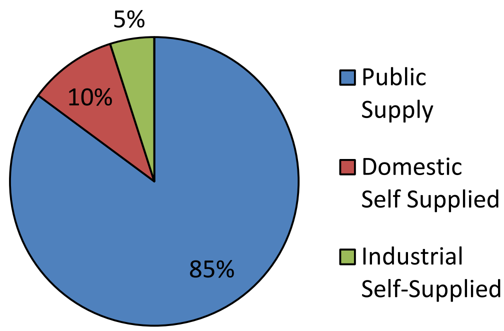
TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Fairbanks	8S	9W	22	2	R10 (SHEEP CREEK ROAD #830, TL2210; Fairbanks)	322	DRY?		
Fairbanks	10S	8W	19	1	PARKS HIGHWAY M227.8, DENALI PARK	186	132	5	10/12/1999
Fairbanks	12S	8W	26	7	R10 (Various)	150 - 400	91 - 150	3 - 12	1954 - 1997
Fairbanks	13S	7W	1	1	LITTLE COAL CREEK	225	Dry	Dry	11/11/1983
Fairbanks	13S	7W	27	7	R10 (Sheep Ck; Happy Ck; NINE MHILL ROAD 688, TL2732)	196 - 300	80 - 110	9 - 25	1979 -1984
Fairbanks	14S	7W	35	9	R10 (Various)	85 - 200	50 - 134	5 - 18	1963 - 2010
Fairbanks	14S	7W	36	4	R10 (Various)	124 - 233	56 - 80	1 - 2.5	1961 - 1974
Fairbanks	15S	6W	11	9	R10 (Murphy Dome Rd; Drouin Spring)	92 - 270	71 - 234	4 - 15	1975 - 1989
Fairbanks	15S	6W	14	1	R7 (Cantwell)	40	4	40	2002
Fairbanks	15S	6W	16	1	R10 (SKYLINE HEIGHTS 1 L11 B2)	365	300	10	7/9/2007
Fairbanks	15S	7W	33	2	R7 (Cantwell)	40, 40	12, 10	25, 40	1996
Fairbanks	20S	10W	14	2	OLD WOOD ROAD 1069 / OLD NENANA HIGHWAY	380	210	8	8/1/1998
Seward	32N	3W	34	18	R7	43 - 760	12 - 116	1.5 - 150	1984 - 2000
Seward	26N	5W	26	2	R6 (TAPS 06, PIPE M355, ELEV 877 FT, NEAR YUKON RIVER)	800, 275	606, flowing	30, 20	1976, 1975
Seward	26N	5W	21	1	DENALI RIVERSIDE RV PARK	160	80	60	6/23/1996

TABLE 5.2-13 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Seward	24N	5W	24	4	R7	138 - 480	127 - 270	0.5 - 20	1998 - 2004
Seward	22N	4W	23	1	MARION CREEK CAMPGROUND 1	50	18.5	90	7/31/1993
Seward	21N	4W	2	1	M25.5 PARKS HIGHWAY, HEALY	280	155	7	3/31/1981
Seward	21N	4W	12	3	Healy Area	100, 80, 73	73, 53, 63	15, 30, 15	1995 - 1998
Seward	21N	4W	13	26	R7, R8, R10	60 - 360	39 - 238	2 - 70	1984 - 2005
Seward	20N	5W	7	1	YUKON RIVER BRIDGE	240	142	21.4	6/17/1974
Seward	20N	4W	20	1	PARKS HIGHWAY M260.0 ROCK CREEK	40	9	7	6/24/2001
Seward	16N	4W	7	2	R7 (ASLS 85-237 Tr A; PARKS HIGHWAY M264.5, HEALY - No well data)	400	265	250	6/9/2000
Seward	16N	4W	15	1	R7 (QUOTA L20 B13)	220	190	10	1985
Seward	15N	4W	12	1	R7 (REX TRAIL)	515	426	6	8/27/2000
Seward	15N	4W	14	2	R7 (PARKS HIGHWAY M278 & M276)	229, 216	190, 192	10, 10	1986, 2001

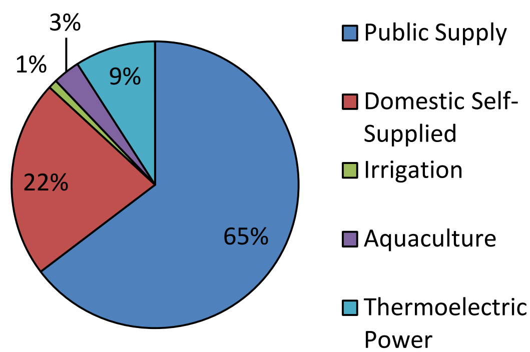
Source: ADNR 2011.



Source: USGS 2010b.

FIGURE 5.2-9 Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts, and Lower Tanana River Watersheds – 2005 Fresh Groundwater Use (Percent)

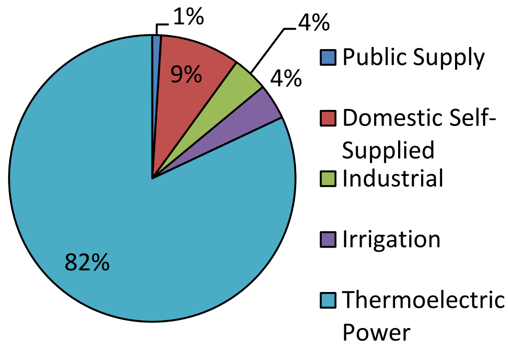
The Tolovana and Tanana Flats watersheds are represented by the Fairbanks North Star Borough estimates. As shown in Figure 5.2-10, well over half (65 percent) is used for public supply, about a quarter (22 percent) for domestic self-supplied, and 9 percent for thermoelectric power with lesser amounts 3 percent and 1 percent for aquaculture and irrigation uses respectively.



Source: USGS 2010b.

FIGURE 5.2-10 Tolovana River and Tanana Flats Watersheds – 2005 Estimated Fresh Groundwater Use (Percent)

The Nenana River watershed is located entirely within the Denali Borough. As shown in Figure 5.2-11, the groundwater use in this watershed is 82 percent thermoelectric power, 9 percent domestic self-supplied, 4 percent industrial, 4 percent irrigation, and 1 percent use for public supply.



Source: USGS 2010b.

FIGURE 5.2-11 Nenana River Watershed – 2005 Estimated Fresh Groundwater Use (Percent)

Groundwater Quality

The Interior-Yukon Hydrologic Subregion has no PWSs with groundwater as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS groundwater quality sites in the Yukon-Koyukuk Hydrologic Subregion are located within the proposed Project area (Appendix G). The proposed Project ROW in this subregion generally follows the TAPS ROW.

The data available in the Upper Koyukuk River watershed (UK-G1, not shown in Appendix G) is relatively recent (2003), but data collected only covers a few parameters. It is located at Anakutuvuk Pass (which is not in the proposed Project area) and may not be representative because it does not represent effects from the development of the TAPS. There was no USGS groundwater monitoring sites with water quality data found in the South Fork Koyukuk or Ramparts watersheds. The Kanuti River watershed had data (Ka-G1) near the TAPS but was collected before the TAPS was constructed so again it may not be representative.

The Tolovana River watershed had no sites that met the selection criteria; however, Site To-G1, near Minto, is likely representative because most of proposed Project area in this watershed was not affected by the development of the TAPS. The data was collected in 1971; this site is more than 10 miles from the proposed Project area. Site To-G1 met the WQS for color, pH, and total dissolved solids for all water uses (Table 5.2-14).

The Lower Tanana River watershed had no sites that met the selection criteria (Table 5.2-14). However, Site LT-G1 is likely representative because most of proposed Project area in this watershed is not affected by the TAPS. The data is from 1971 and the site is more than 10 miles from the proposed Project area. Site LT-G1 shows groundwater quality in the watershed met WQS for color, pH, and total dissolved solids for all water uses. There is no groundwater quality data in the Nenana River watershed after 1970.

The Tanana Flats watershed had no sites that met the selection criteria (Table 5.2-14). Site TF-G1 is listed but is fairly distant from the proposed Project area and the data was collected in 1979. Although there has likely been some population growth in this corridor since 1979, this is the most representative data for this watershed (Table 5.2-14). The data from

TABLE 5.2-14 Summary of Groundwater Quality – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium **(µg/L)**	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Upper Koyukuk River (19040601)											
680805151443001	UK-G1	9/10/2003	1.7	--	--	12.0	7.8	--	--	E-143	--
South Fork Koyukuk (19040602)											
N/A - see Ka-G1											
Kanuti River (19040604)											
66273410383601	Ka-G1	5/2/1974	3.0	--	6	--	8.3	--	--	--	--
Ramparts (19040404)											
N/A - see Ka-G1											
Tolovana (19040509)											
650920149202501	To-G1	5/10/1971	--	--	5	--	7.2	--	--	366	--
Lower Tanana (19040511)											
645320149105501	LT-G1	5/10/1975	--	--	5	--	7.2	--	--	366	--
Nenana River (19040508)											
N/A											
Tanana Flats (19040507)											
644235147090001	TF-G1	8/30/1979	9.0	--	--	--	7.2	--	--	--	--

°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

TF-G1 shows the groundwater quality in this area met the WQS for temperature and pH for all water uses.

Floodplains

Peak flows from rivers that originate on the south side of the Brooks Range (Upper Koyukuk) are triggered by intense rainfall (BLM 2002). The rivers originating in the Alaska Range (Nenana) are characterized by low winter flows and wide braided channels with aufeis. The headwaters of the other rivers exist either in the area between the Brooks Range and the Alaska Range (South Fork Koyokuk, Kanuti, Tolovana, Tanana Flats, and Lower Tanana); or the watershed does not include the headwaters of the associated river (Yukon River in the Ramparts watershed).

The proposed Project area in the Interior Hydrologic Subregion is in the Yukon-Koyukuk Census Area and the Denali Borough. There are no available FEMA floodplain maps for either of these areas (FEMA 2011). There are 16 USGS stream gauge stations with mean peak stream flow data available near the proposed Project area in the Interior Yukon Hydrologic Subregion. Table 5.2-15 summarizes the mean peak stream flow, elevation data and years of record at these gauging stations. The Stream High Water Marks Maps presented in Appendix G show the maximum elevation of record (or high water mark) about 2 miles upstream of gauging stations on major rivers and about one mile upstream of gauging stations on tributaries. The high water marks represent from four to 48 years of data, but probably do not reflect a 100 year flood.

5.2.1.7 Southcentral Hydrologic Subregion

Watershed Characteristics

This hydrologic subregion includes the south side of the Alaska Range and the Matanuska-Susitna Valley (TAPS Owners 2001). The south side of the Alaska Range descends into the Matanuska-Susitna Basin. The Alaska Range trends east to west and possesses discontinuous permafrost (TAPS Owners 2001). The proposed Project area includes the Chulitna River and Lower Susitna River watersheds.

<u>Chulitna River Watershed – HUC 19020502 (2,590.87 sq. miles)</u>

The Chulitna River originates in the Alaska Range south of Broad Pass on the Parks Highway. The headwaters are glacier-fed and flow south along the Parks Highway to Talkeetna, where it joins the Susitna River and discharges into the Lower Susitna River watershed. The proposed Project area generally follows the Parks Highway.

TABLE 5.2-15 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds Near the Proposed Project – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Upper Koyokuk (19040601)						
15564864	Dietrich River Trib near Wiseman	2004-2011	8	1,954 (2004)	2,146[b] (2009)	98
15564868	Snowden Creek near Wiseman	1968-2004	29	1,630 (1993)	1,678[d] (1991)	441
15564875	Koyukuk River near Wiseman	1968-1994	16	1,090 (1979)	1,114[d] (1973)	14,455
15564877	Wiseman Creek at Wiseman	1971-1994	11	1,096 (1974)	1,140[c,d] (1994)	704
15564879	Slate Creek at Coldfoot	1981-2011	31	1,035 (2007)	1,070[d] 1984)	1,643
South Fork Koyukuk (19040602)						
15564887	Bonanza Creek Trib near Prospect Camp	1975-2011	37	1,009 (1976)	1,066 (2009)	156
Kanuti (19040604)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ramparts (19040404)						
15453610	Ray River Trib near Stevens Village	1977-2011	35	584 (1980)	622[d] (1994)	82
15453500	Yukon River near Stevens Village	1964-2011	36	204 (1999)	300 (1992)	496,639
15457800	Hess Creek near Livengood	1971-2011	16	389 (1974)	518 (2009)	5,466
Tolovana (19040509)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lower Tanana (19040511)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Tanana Flats (19040507)						
15515500	Tanana River at Nenana	1948-2011	51	330 (1996)	357[d] (1967)	84,782
Nenana (19040508)						
15518300	Nenana River near Rex	1965-1968	4	678 (1965)	702[d] (1968)	32,350
15518080	Lignite Creek near Healy	1986-2011	26	1,298 (2011)	1,311[d] (1986)	642
15518000	Nenana River near Healy	1951-1979	29	1,262 (1973)	1,284[d] (1967)	22,017
15517980	Dragonfly Creek near Healy	1990-2008	19	1,474 (1994)	1517 (2007)	88

TABLE 5.2-15 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds Near the Proposed Project – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
15516198	Slime Creek at Intertie near Cantwell	1990-1995	6	2,195 (1991)	2,206[c] (2007)	158
15516000	Nenana River near Windy	1951-1981	28	2,095 (1969)	2,110[d] (1962)	6,954

[a] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.
[b] Gauge height affected by backwater.
[c] Gauge height not the maximum for the year.
[d] Gauge height at different site and (or) datum.
Source: USGS 2010e. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

Lower Susitna River Watershed – HUC 19020505 (3,703.25 sq. miles)

The Lower Susitna River originates in the Talkeetna Mountains (in the Upper Susitna watershed) which joins with the Chulitna River and flows south through the Lower Susitna watershed and into the Cook Inlet. Much of the Upper and Lower Susitna River watersheds are low-lying, low gradient areas that moderate the influence of the mountainous terrain (STB 2011). The proposed Project area intersects the Lower Susitna watershed, starting at Talkeetna and ending at the proposed Project terminus.

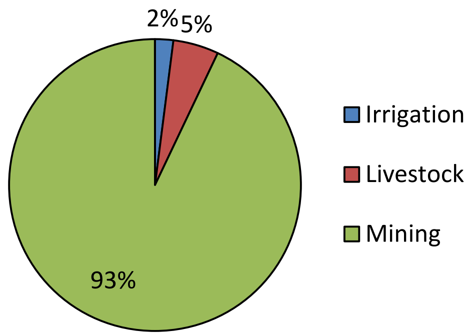
Surface Water

Surface Water Availability

The rivers and streams that cross the proposed Project are shown in Appendix E arranged from north to south. Appendix F illustrates the location, surface area, and type of lake or pond located within 1 mile on either side of the proposed Project ROW in the Southcentral Hydrologic Subregion.

Surface Water Use

The Southcentral Hydrologic Subregion consists of a couple different boroughs and census areas (Figure 5.2-4 and Appendix G). The Chulitna and Lower Susitna River watersheds are entirely encompassed within the Matanuska-Susitna (Mat-Su) Borough. Based on data provided previously in Table 5.2-1, surface water is used primarily for mining (93 percent) with five percent for livestock and 2 percent for irrigation as shown in Figure 5.2-12.



Source: USGS 2010b.

FIGURE 5.2-12 Chulitna and Lower Susitna River Watersheds – 2005 Fresh Surface Water Use (Percent)

Surface Water Quality

The Southcentral Hydrologic Subregion has no PWSs with surface water as a primary source listed on the EPA's SNC List (ADEC 2011b). None of the selected USGS surface water quality sites are located within the proposed Project area (Appendix G) and this segment of the proposed Project is not associated with the TAPS ROW. The Chulitna River watershed has 5 sites (Chu-S1 to Chu-S5) that met the selection criteria listed in Section 5.2.1; this data was collected in 2000, 1974, 1985, and 2012 respectively. There has been population growth in this corridor since 1985, so the 2000 data collected at Chu-S1 is probably the only representative data available. Based on the data from Chu-S1, the fresh surface water in the Chulitna River watershed met the WQS for temperature, dissolved oxygen, pH, total dissolved solids, and suspended sediments for all water uses (Table 5.2-16).

The Lower Susitna River watershed has four sites (LS-S1 to LS-S4) that met the selection criteria listed in Section 5.2.1; this data was collected in 1985, 1983, 1973, and 2012 respectively (Table 5.2-16). The proposed Project area is not associated with the TAPS ROW. There has been population growth in this corridor since 1985, so it is questionable whether any of these sites show representative data. Note that Big Lake and Cottonwood Creek are on the ADEC list for impaired waters, as described in Section 5.2.1.

In 2008, the State Transportation Board Section of Environmental Analysis collected surface water quality data at selected streams near the Port MacKenzie Rail Line Extension (STB 2011). This data is presented in Table 5.2-17.

TABLE 5.2-16 Summary of Surface Water Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium **(µg/L)**	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment mg/L)
Chulitna River (19020502)											
15292302	Chu-S1	9/7/2000	5.3	--	--	13.2	7.5	67.3	--	E 35	<1
624431150070600	Chu-S2	6/11/1974	14.0	--	3	--	--	--	--	30	--
15292410	Chu-S3	9/17/1985	3	--	--	--	--	--	--	--	544
15292400	Chu-S4	7/11/2012	--	220	--	--	--	--	--	--	--
15293200	Chu-S5	6/26/2012	8.7	--	--	--	--	--	--	--	--
Lower Susitna River (19020505)											
15292780	LS-S1	6/25/1985	9.2	190	--	10.5	8.2	--	--	73	488
15294012	LS-S2	7/26/1983	14.0	--	--	9.7	7.0	--	--	--	--
614300150064900	LS-S3	6/19/1973	15.5	--	4	--	7.6	--	--	78	--
15292800	LS-S4	7/2/2012	12.7	--	--	--	--	--	--	--	--

°C = degrees Celsius.
NTU = nephelometric turbidity units.
Pt-Co = Platinum Cobalt units.
mg/L = milligrams per liter.
pH = measure of the acidity or alkalinity of a solution.
s.u. = standard units.
µg/L = micrograms/liter.
E means estimated, N/A means not available.
Representative data sites are bolded, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

TABLE 5.2-17 Stream Surface Water Quality Data Collected in 2008 by OEA for the Port MacKenzie Rail Extension Project

Longitude	Latitude	Map ID	Dissolved Oxygen (mg/L)	Temperature (°C)	Turbidity (NTUs)	Total Dissolved Solids (mg/L)	pH (s.u.)	Conductivity (µS/cm)	Port Mackenzie Segment and MP
-150.137363000	61.441757000	STB-S1	9.9	13.8	4	130	7.6	201	C1-2.6
-150.114200000	61.472380000	STB-S2	11.9	16.7	120	120	7.5	179	H-0.8
-150.153980000	61.377590000	STB-S3	10.0	14.7	92	140	7.1	200	MW-11.0
-150.136320000	61.368830000	STB-S4	12.3	6.2	15	160	6.9	240	MW-10.1
-150.072770000	61.306850000	STB-S5	9.7	12.8	4	100	7.5	160	MW-4.6
-150.063967000	61.810311000	STB-S6	11.9	15.6	64	80	7.2	127	MP-190.3
-150.063740000	61.791420000	STB-S7	10.1	13.6	27	60	6.8	80	MP-189
-150.124950000	61.778160000	STB-S8	11.8	11.4	12	50	6.2	70	W-24.0
-150.148625000	61.735021000	STB-S9	11.5	11.9	27	80	7.3	118	W-20.9
-150.158330000	61.678370000	STB-S10	7.2	13.7	9	80	6.9	120	W-16.7
-150.211930000	61.592310000	STB-S11	10.7	18.9	54	60	7.1	90	W-10.0
-150.138240000	61.472220000	STB-S12	12.3	14.1	5	70	7.6	110	W-0.6

mg/L = milligrams per liter; °C = degrees Celsius; NTU = nephalometric turbidity units; pH = measure of acidity or alkilinity of a solution; s.u. = standard units; µS/cm = micro-siemens per centimeter
Source: STB 2011.

Table 5.2-18 shows the ADEC's classification of waterbodies in the Southcentral Hydrologic Subregion. There are two waterbodies included in Category 5, which are impaired waters identified under Section 303(d) of the CWA. Most of the waterbodies remain unclassified, but the ADEC expects that most would be in Category 1 (ADEC 2010). Waterbody classification definitions are provided in Section 5.2.1.4.

TABLE 5.2-18 ADEC Waterbody Classification – Southcentral Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Chulitna River	0	0	0	0	0
Lower Susitna River	0	Cottonwood Creek	Birch Creek Canoe Lake Cottonwood Lake Deshka River Finger Lake Goose Bay Goose Creek Kalmbach Lake Little Susitna River Meadow Creek Memory Lake Montana Creek (Talkeetna) Nancy Lake Susitna River Wasilla Creek Wasilla Lake Willow Creek	Lake Lucille	Big Lake Cottonwood Creek

The Category 5 waterbodies listed as impaired by the ADEC are Big Lake and Cottonwood Creek in the Lower Susitna River watershed. The Category 4a waterbody listed as having an EPA-approved TMDL is Lake Lucille in the Lower Susitina River watershed. The Category 5 listings are described below.

<u>Lower Susitna River Watershed</u>

Big Lake

The area of concern is 1,250 acres located in Wasilla for the Petroleum Hydrocarbon WQS. The ADEC states: "Big Lake was Section 303(d) listed in 2006 for non-attainment of the petroleum hydrocarbon (TAH) water quality standard. DEC collected water quality information at Big Lake in the open water months in 2004, 2005, and 2009. Petroleum hydrocarbon (TAH) sampling was conducted in the water column at multiple sites, depths, and degrees of motorized watercraft activity throughout the lake. Sampling sites in areas that received heavier use by motorized watercraft consistently exceeded the WQS for TAH and the concentrations are likely influenced by a combination of good weather and time of season. The sample events that coincided with the higher mean temperatures are likely also prime recreational dates based on the increased motorized watercraft usage at these times. Specifically, the areas of impairment together equal an estimated 1,250 acres and are seasonal in nature, from May 15 to September 15 with particular impairment issues on two holiday weekends (Memorial Day and Independence Day). The following specific areas in the east basin are the areas of impairment: harbors and marinas launch areas, and traffic lanes. Sampling was conducted outside these specific areas and exceedances were not identified. Although no water quality samples were collected below five meters, it is considered unlikely that petroleum contaminated sediment is a concern. The source of petroleum is from motorized watercraft. Management measures will focus on reducing petroleum hydrocarbon inputs at harbors and marinas, launch areas, and traffic lanes of the east basin on busy holiday weekends" (ADEC 2010).

Cottonwood Creek

The area of concern is 7 miles of Cottonwood Creek located in Wasilla for the Fecal Coliform Bacteria WQS. The ADEC states: "Cottonwood Creek (13 miles) was Section 303(d) listed in non-attainment of the residues standard for foam and debris in 2002/2003. DEC has received numerous complaints about foam in Cottonwood Creek and foam was observed in the creek in 1998, 2000, 2001, and 2002. Through grant funds, an intensive water quality evaluation was conducted on Cottonwood Creek beginning in September 2004 and continuing through June 2006 for a TMDL assessment. Water quality sampling conducted in 2004 and 2005 indicated that the foam present in Cottonwood Creek is most likely naturally occurring. However, hydrologic changes within the watershed may be influencing the amount and timing of the foam. Continued water quality sampling in 2006 focused on determining the extent of FC bacteria and temperature exceedances discovered during the sampling for foam, as well as further investigation of the foam. Foam and temperature were determined to be naturally occurring hence meeting WQS. FC bacteria exceeded WQS, and the source(s) is unknown. Cottonwood Creek is now in Category 2 for attainment of the residues (foam) standard and impaired for FC bacteria" (ADEC 2010).

Groundwater

Groundwater Availability

Groundwater is available in the Southcentral Hydrologic Subregion because permafrost is not continuous. Table 5.2-19 presents data on private wells in the Southcentral Hydrologic Subregion from WELTS (ADNR 2011).

TABLE 5.2-19 Well Data from WELTS – Southcentral Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Fairbanks	1N	2W	18	1	R23C (SUSITNA LANDING L05 PLAT80)	219	19	60	9/20/2000
Fairbanks	15S	6W	20	4	R23C (McKinley View Estates; PARKS HIGHWAY M135.0)	60 - 260	42 - 65	0.7 - 200	1970 - 2004
Fairbanks	2N	1E	3	5	R23C (PARKS HIGHWAY M147.0, BYERS LAKE; Byers Creek Landing)	59 - 259	24.5 - 108	2.83 - 20	1995 - 1996
Fairbanks	1N	2W	19	1	R23C (CASWELL AREA)	145	24	40	7/27/2001
Fairbanks	12S	8W	30	1	R23B (SPACIOUS KASWITNA ES L6 B1)	61	35	600	9/28/1985
Fairbanks	15S	6W	31	4	R23C (PARKS HIGHWAY M191)	70 - 100	40 - 53	6 - 40	1988 -1997
	19N	4W	32	5	R23C (Timber Park)	37 - 60	10.1	40	1984 - 1998
Fairbanks	1N	2W	29	5	R23C (SUNSHINE AREA)	38 - 96	18 - 65	7.5 - 40	1984 - 1987
Fairbanks	1N	2W	32	3	R23A&C (Matsu HS; Sunshine HS; Montana Cr, Talkeetna)	60 - 120	38	50	1972 - 1991
Fairbanks	1N	2W	13	3	R23C (MATSU SUNSHINE Landfill)	33, 70, 42	no wells	no wells	no wells
Fairbanks	1N	3W	14	2	R23C (PARKS HIGHWAY M102.8, SUNSHINE)	146, 174	80, 67	10, 40	1985, 1997
Fairbanks	1N	2W	20	1	R23C (Trapper Creek)	40	29	24	5/22/1996
Fairbanks	14N	4W	13	1	PARKS HIGHWAY M188.5	285	127	45	5/21/1973
Fairbanks	14S	7W	15	1	R23C (WHEATLEY L01 B2, SUSITNA RIVER RD)	89	75	10	10/18/2007
Fairbanks	17S	7W	4	1	DENALI HIGHWAY M133.5, CANTWELL	50	14	50	5/15/1992
Seward	30N	5W	29	2	R23A (GOOSE CRK ESTATES L02 B1&B3)	60, 65	22.25	40	1999
Seward	29N	5W	32	2	R23C (PARKS HWY M 84.5 & 85.0)	87	30	10, 65	1974, 2003
Seward	26N	5W	32	1	R23C (PARKS HIGHWAY M114.2)	40	6	40	6/7/1991
Seward	24N	4W	17	3	R23C (PARKS HIGHWAY M094.5)	60 - 82	44	12, 36	1983, 2002
Seward	24N	4W	30	3	R23B (Various)	60, 61, 85	32, 36, 50	7, 20, 18	1991 - 2004

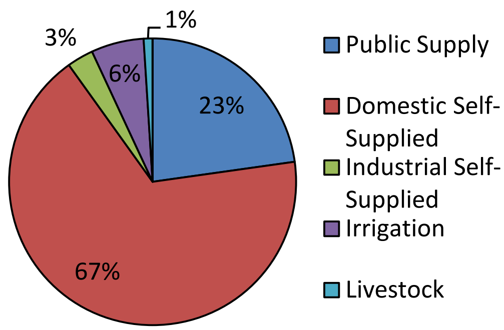
TABLE 5.2-19 Well Data from WELTS – Southcentral Subregion

Meridian	Township	Range	SECTION	No. of Wells (WELTS)	Location	Well Depth (ft. below GL)	Static H2O Level (ft. below GL)	Flow Rate (GPM)	Date Well Completed
Seward	24N	5W	13	1	R23B (L012, 4500 E WILLOW CIRCLE)	100	26	16	10/24/2007
Seward	23N	4W	7	1	R23C (L009, KASHWITNA AREA)	128	18	20	8/28/1991
Seward	23N	4W	8	4	R23C (Montana Creek)	40 - 75	15 - 21	4, 40	2000 - 2003
Seward	23N	4W	17	2	R23C (SHEEP CREEK AREA; Willow)	50, 80	42, 20	20	1984, 1996
Seward	23N	4W	29	2	R22C & R23B (Willow);	55, 112	10, 38	33, 38	1965, 2007
Seward	22N	4W	4	2	R23C (TROUBLESOME CREEK)	64, 101	9.5, 77	50, 10	1983
Seward	20N	4W	6	6	R23B (Willow Area)	69 - 191	3' above - 50' below GL	25 - 126	1979 - 1988
Seward	20N	5W	29	11	R23C (Trapper Creek)	34 - 250	6 - 37	6 - 75	1973 - 1996
Seward	16N	5W	35	3	R23A (PT. MACKENZIE AGRICULTURAL PROJECT)	40 - 241	40 - 239	2 - 28	1982, 1984
Seward	14N	4W	6	13	(PT. MACKENZIE AGRICULTURAL PROJECT)	39 - 320	18 - 120	20 - 200	1984, 1997

Source: ADNR 2011.

Groundwater Use

The Southcentral Hydrologic Subregion consists of a couple boroughs and census areas. Well over half (67 percent) of the groundwater is used for domestic self-supplied, about a quarter (23 percent) for public supply, 6 percent for irrigation, 3 percent for industrial self-supplied, and 1 percent for livestock use as shown in Figure 5.2-13.



Source: USGS 2010b.

FIGURE 5.2-13 Chulitna and Lower Susitna River Watersheds – 2005 Fresh Groundwater Use (Percent)

Groundwater Quality

The Southcentral Hydrologic Subregion has two PWSs with groundwater as a primary source listed on the EPA's SNC List with a score of 11 or higher (ADEC 2011b). These include:

- Bluffview Acres Water System (AK2223624) (Community Water System) for arsenic, located in Wasilla; and
- East Big Lake Water System (AK2224581) (Non Transient Non Community System) for arsenic and LCR, located in Big Lake.

None of the selected USGS groundwater quality sites in the Southcentral Hydrologic Subregion are within the proposed Project area (Appendix G). The USGS groundwater monitoring sites did not have water quality data for the Chulitna River watershed. See the Lower Susitna for representative groundwater quality sites.

The Lower Susitna River watershed has three sites (LS-G1, LS-G2, and LS-G3) that met the selection criteria; however, there has been substantial population growth since 1977 when LS-G2 data was collected. Only LS-G1 and G3 are considered representative of the proposed Project area. At LS-G1, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature and pH for all water uses. At LS-G3, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature, pH, and total dissolved solids for all water uses (Table 5.2-20).

TABLE 5.2-20 Summary of Groundwater Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium **(µg/L)**	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Chulitna River (19020502)											
N/A											
Lower Susitna River (19020505)											
621019150070401	LS-G1	6/13/1991	5.5	--	--	--	6.6	--	--	--	--
615937150025001	LS-G2	6/2/1977	--	--	11	--	--	--	--	98	--
61391014949301	LS-G3	7/12/2000	5.0	--	--	--	7.5	--	--	E 182	--

°C = degrees Celsius.
NTU = nephelometric turbidity units.
Pt-Co = Platinum Cobalt units.
mg/L = milligrams per liter.
pH = measure of the acidity or alkalinity of a solution.
s.u. = standard units.
µg/L = micrograms/liter.
E means estimated, N/A means not available.
Representative data sites are **bolded**, parameters that may exceed a WQS are highlighted gray.
Source: USGS 2010c. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.)

Floodplains

The timing of peak flow of rivers in this region depends largely on the gradient of the watershed and is reflected in annual rainfall-runoff hydrographs. The proposed Project area in the Southcentral Hydrologic Subregion is located within the Mat-Su Borough, and there are no available FEMA floodplain maps for the specific area of the proposed Project ROW (FEMA 2011). Areas within the proposed Project footprint that are not mapped by FEMA are designated as having possible but undetermined flood hazard risks.

There are 4 USGS stream gauge stations with peak stream flow data available near the proposed Project area in the Southcentral Hydrologic Subregion. Table 5.2-21 summarizes the period of record for these stream gauges, the minimum and maximum water elevation and the mean peak stream flow. The Stream High Water Marks Near Project Map for the Southcentral Hydrologic Subregion presented in Appendix G shows the maximum elevation of record (or high water mark) about 2 miles upstream of gauging stations on major rivers and about 1 mile upstream of gauging stations on tributaries. The high water marks represent from 4 to 49 years of data, but probably do not reflect a 100 year flood.

TABLE 5.2-21 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds Near the Proposed Project – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Chulitna (19020502)						
15292400	Chulitna River near Talkeetna	1958-2006	28	510 (1969)	547 (2006)	44,318
15293200	Kashwitna River near Willow	2011-2012	1	265 (2011)	269 (2012)	978
Lower Susitna (19020505)						
15292800	Montana Creek near Montana	1963-2011	17	243 (2010)	270[c] (1986)	4,121
15292990	Sheep Creek near Willow	1984-1986	4	223 (1986)	230 (1986)	2,853
15293000	Caswell Creek near Caswell	1963-1987	25	170 (1970)	199 (1986)	136
15292780	Susitna River at Sunshine	1971-1987	7	282 (1983)	332 (1971)	139,571

[a] "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.

[b] Discharge is an historic peak.

Source: USGS 2010e. (Disclaimer: The data from the USGS NWIS Web database may include data that have not received Directors approval and is provisional and subject to revision.

5.2.2 Environmental Consequences

This section describes the temporary (construction) and permanent (operation and maintenance) activities; and direct and indirect potential impacts of the proposed Project on surface water, groundwater, and floodplains. Other resource sections address potential impacts associated with water resources, such as Section 5.4 (Wetlands), 5.6 (Fish), 5.14 (Subsistence), and 5.17 (Navigation).

5.2.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed, and there would be no surface water, groundwater, or floodplain impacts.

5.2.2.2 Proposed Action

Preconstruction Activities

Water Requirements

Substantial water quantities would be required for proposed Project development. Water would be withdrawn from permitted lakes for ice road and pad construction and for temporary work camps. A minimum of 975 MG of water would be required to support construction activities (ice work pads, ice access roads and earth work)for the proposed Project (AGDC 2011b). Details on proposed water requirements for each Spread are included in Table 5.2-22. Final locations of waterbodies proposed for water withdrawal along the entire route will be defined later in the process after additional analysis is complete. Each waterbody will be permitted for water use dependant on fish presence, lake depth and location along the proposed ROW. Table 5.6-5 in Section 5.6.2.2 includes the maximum withdrawal limits for 13 lakes located in the Arctic Subregion that possess fish. Impacts to water resources could include altered water quality from water withdrawals including decreased oxygen concentrations, increased organic matter, turbidity, and changes to pH (AGDC 2011c). Additional impacts could occur to other resources that rely on water, which would include fish resources (Section 5.6).

Ice Roads

Ice roads would be developed in the Arctic region over the two winter construction seasons to access waterbodies, and to construct the ROW. Ice chips and unfrozen water would be used to build and maintain ice roads throughout the construction season. Proper ice road development would not adversely affect surrounding water resources. Ice bridges may form and persist across rivers and streams where ice roads were developed. Ice roads and potential bridges would melt slower than the surrounding ice in the stream; however, standard ice road mitigation includes slotting the ice at stream crossings and outlets before breakup to allow streams to flow as the snow pack melts. The primary impact from ice bridging across streams would include flooding during spring break up resulting in increased sedimentation loads which is also natural during spring break up from floods. This would be expected to be a temporary and local impact to water resources; however, would also impact fish resources as noted in Section 5.6, Fish.

TABLE 5.2-22 ASAP Water Use Requirements by Construction Spread and Section

Spread	Section	Location	Start MP	End MP	Miles	Season	Hydrotest	Workpads	Access Roads	Earthwork	Project Total
1	1A	GCP to PS-1	0	6	6	W1	276,000	15,000,000	-	462,200	15,738,200
1	1B-1	PS-1 to Happy Valley	6	88	82	W1	4,715,000	168,116,000	1,150,654	538,700	174,520,354
1	1B-2	Happy Valley to Atigun River Valley	88	163	75	W2	8,625,000	74,736,000	1,450,829	951,100	85,762,929
1	1C-1	Atigun River Valley to North Atigun Pass	163	173	10	S1	1,150,000	-	77,343	239,800	1,467,143
1	1C-2	North Atigun Pass to Chandalar Shelf	173	183	10	S2	1,150,000	-	389,310	200,800	1,740,110
2	2A-1	Chandalar Shelf to Coldfoot	183	248	65	W1	7,475,000	42,352,000	469,334	470,200	50,766,534
2	2A-2	Coldfoot to Prospect River	248	286	38	W2	4,370,000	50,288,000	498,635	1,286,200	56,442,835
2	2B	Prospect River to Ray River	286	348	62	S1	7,130,000	93,264,000	5,283,432	2,449,600	108,127,032
2	2C	Ray River to Yukon River	348	360	12	W2	1,380,000	19,200,000	39,636	206,900	20,826,536
3	3A	Yukon River to Livengood	360	405	45	S1	5,175,000	67,984,000	3,375,594	2,038,700	78,573,294
3	3B-1	Livengood to Little Goldstream	405	468	63	W1	7,245,000	86,880,000	36,853,202	30,837,600	161,815,802
3	3B-2	Little Goldstream to Healy	468	529	61	W2	7,015,000	31,008,000	12,812,515	407,400	51,242,915
4	4A-1	Healy to Nenana River	529	535	6	S1	690,000	8,496,000	101,353	2,700	9,290,053
4	4A-2	Nenana River to Lynx Creek	535	541	6	F1 / W2	690,000	-	247,521	766,500	1,704,021
4	4B	Lynx Creek to Honolulu Creek	541	602	61	S1	7,015,000	-	2,434,047	994,200	10,443,247
4	4C-1	Honolulu Creek to Susitna River	602	673	71	W1	8,165,000	-	456,119	370,300	8,991,419
4	4C-2	Susitna River to Beluga PL MP 39	673	736.41	63.41	W2	7,291,000	70,250,000	1,111,778	2,539,500	81,192,278
FBKS LAT	FBKS LAT	Mainline (MP 458.75) to Fairbanks	0	34.43	34.43	S2	1,032,900	55,088,000	-	-	56,120,900
						Totals:	80,589,900	782,662,000	66,751,302	44,762,400	974,765,602

Source: AGDC 2011b.

Pipeline Right-of-Way

Mainline

Construction

The proposed Project ROW would be 737 miles in length and extend from Prudhoe Bay to an area near the Upper Cook Inlet. The water resources potentially impacted within the proposed Project area are included in Figure 5.2-1. The proposed ROW would generally follow the TAPS ROW and the Dalton Highway corridors from Prudhoe Bay to Livengood. At Livengood the ROW would follow a southerly route through Minto Flats, joining the George Parks highway near Nenana. The ROW would cross approximately 495 waterways and drainages, of which 27 are major streams, 75 have been confirmed as anadromous streams, and an additional 7 have been nominated for inclusion in the Anadromous Waters Catalog (AGDC 2011d). The pipeline would be buried approximately 5 feet deep throughout the entire length of the ROW except for the first 6 miles and at elevated pipeline bridge and highway stream crossings, compressor stations, possible fault crossings, pigging facilities, and off-take valve locations.

Construction activities for the ROW would include clearing vegetation, grading over the centerline and excavating a trench within the proposed ROW for pipeline installation. The primary construction impacts to surface waters would be from excavation in waterbodies at stream crossings. Disturbance to ground cover in relation to streams would occur within the 100 foot construction ROW by one of four methods noted below. Pipeline placement would be positioned near streams, rivers and railways to take stream bank erosion effects into consideration. Final details of placement of the pipeline would be determined at a later date. Table 5.2-23 provides a summary of the number of waterbody crossings for each segment of the mainline pipeline by watershed, waterbody type, and crossing method. Wetland resource impacts would occur in addition to the water resources included in Table 5.2-23, and is included in the Section 5.4, Wetlands. Note that construction methodology analysis has not been completed (AGDC 2010a).

Hydrostatic Testing

Hydrostatic testing would occur directly after the pipeline is placed in the trench (post construction phase) to determine if it is leak free and that is has the strength necessary to meet design criteria. Final tests would be required to meet federal safety regulations. Hydrostatic testing would require approximately 80 MG of water for the proposed Project. Water would be withdrawn from permitted surface waterbodies based on water volume, depth and fish presence. Water limits would be permitted to avoid adverse impacts to fish or their habitat.

Heated (36˚F to 38˚F) and untreated water would be used primarily for hydrostatic testing. In the winter, compressed air or freeze protected water would be used (AGDC 2011b). The release water from hydrostatic testing would occur in permitted uplands and in settling basins in order to comply with discharge permit requirements (AGDC 2011b). Hydrostatic testing plans will be developed later in the process under Best Management Practices (BMPs) and will be developed by the construction contractor and operator of the pipeline.

TABLE 5.2-23 Mainline Pipeline Water Crossing Summary Table

Mainline Pipeline – Original Route		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	New Bridge
GCF to Mile 540	Kuparuk River	6	0	2	9	0	0	0	0	1	0
	Sag River	63	0	2	27	0	0	3	0	1	0
	Upper Koyukuk River	68	0	0	30	0	0	11	0	0	0
	South Fork Koyukuk River	22	0	0	9	0	0	1	0	1	0
	Kanuti River	4	0	0	3	0	0	1	0	0	0
	Ramparts	31	0	0	5	0	0	1	0	0	1
	Tolovana	41	0	1	0	0	0	0	0	1	0
	Lower Tanana	3	0	0	0	0	0	0	0	1	0
	Lower Colville River	0	0	0	2	0	0	0	0	0	0
	Yukon Flats	4	0	0	7	0	0	0	0	0	0
	Middle Fork-North Fork Ch	5	0	0	1	0	0	0	0	0	0
	Nenana River	28	0	1	0	0	0	3	0	0	0
Mile 540 to Mile 555	Nenana River	5	0	0	0	0	0	1	0	0	0
Mile 555 to Cook Inlet NGL Facility	Nenana River	8	0	3	0	0	0	1	0	0	0
	Chulitna river	22	2	9	0	0	0	0	1	1	0
	Lower Susitna River	26	0	13	0	0	0	0	0	4	0
Total		336	2	31	93	0	0	22	1	10	1

[a] According to the USGS National Hydrological Dataset Metadata, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

HDD means Horizontal Directional Drilling. Source: AGDC 2010.

Stream Crossing Methods

Section 2.2.3.2 and Section 5.6, Fish include detailed descriptions of the four waterbody crossing methods: Open-Cut, Open-Cut Isolation, Horizontal Directional Drilling (HDD), and bridge crossings as follows:

- Open-Cut Method – Excavating a trench across a stream or river bed and pulling or carrying the pipe into position. There is no effort to isolate flow;
- Open-Cut Isolation Method – Flow is isolated from excavation using a flume or dam and pump;
- HDD – Pilot hole drilled under riverbed and to the surface on the other bank. No disruption to banks or streambed. Method requires water supply for drilling fluid for entire drilling process and for pre-testing of pipe string; and
- Bridge Crossings – Pipeline attached to existing bridge or a new bridge constructed.

The Open-Cut Method is the most common method proposed for use on the proposed Project, although the Open-Cut Isolation Method would be used in some instances based on presence of overwintering fish or other considerations (AGDC 2011d). The Open-Cut Method would be used to cross: 336 perennial streams, 93 intermittent streams, and 22 artificial paths (Table 5.2-23). Three existing bridges would be used and 41 HDD crossings (Table 5.2-23). The AGDC would use HDD in instances where disruption of the streambed is not permitted (AGDC 2011d).

The Open-Cut Method and Open-Cut Isolation Method would impact surface water quality downstream temporarily because of excavating a trench through the stream beds and banks. Sedimentation would increase resulting in increased turbidity reducing water quality. Permanent impacts could include changes to the stream profile and structure (bed and hyporheic zone) at crossing locations. The substrate could be altered in composition and quality for spawning fish. Streambed scour is not expected to occur due to burial of the pipeline 5 feet below the surface of the ground. In areas of the ROW where the proposed Project is associated with existing utility corridors and ROWs, drainage structures already in place would be utilized. Table 5.2-27 includes the potential impacts from all proposed Project related activities to water resources.

Changes to the hyporheic zone and substrate composition and quality could occur from installation of the pipeline. Impacts also include the loss of riparian habitat at stream crossings. Riparian vegetation plays many important functions in stream health, including erosion and flood control, thermal control, water quality, and acts as a filter reducing sedimentation. Forested riparian vegetation would be lost permanently; however, the area would be maintained to a non-forested vegetation state. Because of the number of open cut stream crossings, potential impacts are considerable but temporary. The AGDC would minimize impacts by performing the majority of open-cut trench crossings in the winter, and minimizing duration of in-stream construction in the summer. Bank and bed scour protection would be installed after pipeline installation using BMPs (AGDC 2011a).

HDD activities could impact water resources from a potential spill of drilling mud which could result in increased sediment in surface waterways, or contamination of ground or surface water. No synthetic or potentially toxic drilling fluid additives would be used for the proposed Project. Proper drilling procedures would contain the mud and prevent releases into surface waters. The minimum required setback between bore and waterbody is 50 feet; however, physical constraints will often result in setbacks of 200 feet or more for the proposed Project (AGDC 2011a). The drilling mud would be composed of bentonite clay, inert solids, and water. The applicant is not planning to use any synthetic additives at this time. The AGDC has listed several mitigation measures that would be used during HDD activities of proposed Project development to prevent potential impacts to water. The AGDC could develop a site specific plan at proposed HDD locations to assess potential issues that could be encountered due to challenges from terrain.

Operations and Maintenance

The short term impacts to water resources during the operation and maintenance of the proposed Project for the mainline ROW could include alteration of stream flow, and increased sedimentation and turbidity reducing water quality. These impacts would occur immediately after construction activities; however, they would be expected to improve over time as conditions from stream disturbance subside. The stream bank at crossing locations would be susceptible to erosion from wind, rain, runoff, and high water events for several years. Streambanks would be recontoured to preconstruction conditions and revegetated; however, it will take time for the natural vegetation to reestablish without high water events (flooding) or the invasion of non-native invasive plants to impede establishment. A Non-native Invasive Plants (NIP) Plan would be implemented to mitigate for this potential impact along stream crossings. Riparian forest vegetation would be a permanent loss, due to the AGDC requirement of mowing the ROW to a non-forested state.

The potential exists for the thermal regime of streams to become altered due to the chilled pipeline. This may result in creating ice dams and aufeis where the ground (stream bottom) over the buried pipe is cooler than the surrounding stream flow. The ice bridges and damming could reduce stream flow downstream altering water quality and reducing fish habitat (Section 5.6, Fish). In areas such as the Arctic Coastal Plain, a warmer pipe temperature compared to the surrounding ambient ground temperature (permafrost) may result in melting of the permafrost. The AGDC plans to mitigate for this by operating the pipe at a temperature that would match the surrounding ground maintaining the thermal regime. Table 5.2-26 summarizes the expected potential water resource impacts after mitigation measures are complete.

Contamination may also occur in the surface water or groundwater due to equipment leaks or fueling activities. The AGDC would conduct all refueling of excavation equipment at least 100 feet from any surface waterbody as a mitigation measure. Groundwater contamination may occur from a refueling spill, but it is considered unlikely and therefore negligible. The AGDC would be required to follow an Erosion Control Plan during construction for all sections of development. Section 5.23, Mitigation provides further details on AGDC proposed mitigation measures for water quality resources.

Project Segments

GCF to MP 540

Construction

Four hundred streams would be crossed in this segment of the proposed Project ROW (Table 5.2-23). The majority (97 percent) would be constructed via open-cut methods, and the remaining 3 percent would be HDD. Twelve watersheds would be potentially impacted by proposed Project construction within their associated drainages. The majority of stream crossings (109) would occur in the Upper Koyukuk River and 96 in the Sag River (Table 5.2-23). Thus, half (51 percent) of the crossings proposed for the GCF to MP 540 segment would occur in these two drainages.

Impacts expected from construction of the ROW would include the impacts noted above under construction of the mainline ROW. Impacts are expected to be temporary during the short (3 day maximum in-stream) construction process per crossing. Sedimentation and turbidity would increase downstream, and riparian habitat would be removed. Riparian habitat in this segment of the proposed Project is primarily tundra and, therefore, should not be reduced as drastically as it would in a forested vegetation type. The potential for stream bank erosion could still occur for a period of time after construction activities or spring break up if constructed during winter. Refer to Section 5.3, Terrestrial Vegetation and Section 5.23, Mitigation for further discussion of impacts and mitigation measures for riparian habitat.

Operations and Maintenance

Impacts to water resources from operations and maintenance of the ROW from the GCF to MP 540 would be the same as what is noted above under mainline pipeline operations and maintenance. Maintaining the thermal regime of the pipeline to prevent ice damming in streams would be required to prevent additional impacts to surface waters.

Yukon River Crossing Options

Three options have been proposed to cross the Yukon River: (the Applicant's Preferred Option) construct a new pipeline suspension bridge, (Option 2) utilize the existing E. L. Patton Bridge on the Dalton Highway, or (Option 3) cross underneath the Yukon River using HDD. The proposed suspension bridge for the Yukon River would be the only bridge constructed for the proposed Project.

New Bridge

Construction of a suspension bridge (the Applicant's Preferred Option) would not place any structure below the ordinary high water mark (AGDC 2011a); therefore, anticipated impacts to water resources would be expected to be negligible. However, riparian habitat would be impacted (see Section 5.3, Terrestrial Vegetation) along the river banks which play an important role in erosion control and therefore sedimentation affecting water quality. These impacts would not cause adverse impact to water resources in the Yukon River.

The impacts to water resources from operations and maintenance of an existing bridge would be similar to those of a new bridge and would be negligible. If a leak occurred in the pipeline segment that aerially crosses the Yukon River, the natural gas would not be expected to cause additional impacts to the water quality of the Yukon River because it would be released into the air as gas. The pipeline would be carefully monitored from facilities to determine the location of leaks due to pressure loss and would be repaired quickly. Regular mowing of the riparian vegetation along either side of the Yukon River crossing could cause additional erosion or sedimentation into the Yukon River due to bank instability. This could affect water quality, but would not adversely affect water resources in the Yukon River.

Existing Bridge

To utilize the existing E.L. Patton Yukon River bridge option (Option 2), the pipeline infrastructure would hang below the bridge surface and there would be a negligible effect on water resources due to construction of this option. The work areas and structures that would be required for development of the suspension bridge would not be required for this option.

HDD Crossing

The HDD option (Option 3) consists of crossing underneath the river, and staying out of the stream completely. The construction impacts to water resources would be similar to HDD crossings.

<u>MP 540 to MP 555</u>

Construction

The proposed Project would construct open-cut crossings across 5 perennial streams in this segment of the ROW, and 1 in an artificial path (Table 5.2-19). Open-cut methods noted above would have the same impacts to water resources for this segment of the ROW. These crossings exist all within the Nenana River watershed.

Operations and Maintenance

Operations and maintenance of the pipeline would not produce impacts to water resources other than what is noted above under mainline pipeline ROW operations and maintenance.

<u>MP 555 to End</u>

Construction

Construction of the ROW would occur in 3 watersheds for this segment of the pipeline: the Nenana River, Chulitna, and Susitna watersheds. Ninety streams would be crossed and of these streams, 57 would be open-cut, 3 under existing bridges, and 30 would be HDD (Table 5.2-23). Construction impacts to water resources for the crossing methods noted above would apply to segment MP 555 to the End of the ROW.

Operations and Maintenance

Operations and maintenance of the pipeline would not produce impacts to water resources other than what is noted above under mainline pipeline ROW operations and maintenance.

Fairbanks Lateral

The Fairbanks Lateral would extend 35 miles east from the mainline pipeline through the Yukon-Koyukuk and Fairbanks North Star Boroughs, crossing 20 streams along its route (Table 5.2-25). It would parallel Goldstream Creek for most of its length. Goldstream Creek is classified as an impaired waterbody by the state of Alaska; therefore, additional protection measures would be implemented to prevent additional impacts to this drainage from road and pipeline development. Construction of the Fairbanks Lateral would be required to meet the requirements of the Goldstream Creek TMDL for turbidity that is scheduled to be completed in 2013.

Construction

All 20 stream crossings are proposed for open-cut methods (Table 5.2-25). Impacts noted above under open-cut construction impacts to streams would apply to the Fairbanks Lateral. Excavation activities across the streambed could impact fish resources, riparian vegetation, and water quality temporarily and locally. Although groundwater drainage pattern alteration from heavy equipment could occur, impacts should also be temporary and localized.

Operations and Maintenance

Potential impacts noted above under mainline operations and maintenance would also apply to the Fairbanks Lateral.

Aboveground Facilities

Gas Conditioning Facility

The GCF and new permanent access roads would be located at MP 0.0 on a 70-acre gravel pad. The potential impacts to surrounding water resources are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, use of water for construction activities and facility consumption. Water use for the GCF operations could include potable water, mud plants, road dewatering, and general facility operations.

TABLE 5.2-24 Denali National Park Route Variation Water Crossing Summary Table

Denali National Park Route Variation		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	New Bridge
Mile 540 to Mile 555 – Proposed Route	Nenana River	5	0	0	0	0	0	1	0	0	0
Denali National Park Route Variation[b]	Nenana River	0	1	1	0	0	0	0	0	0	0

[a] According to the USGS National Hydrological Dataset Metadata, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

[b] One crossing on the Denali National Park Route Variation will be HDD.

HDD = Horizontal Directional Drilling.

Source: AGDC 2010.

TABLE 5.2-25 Fairbanks Lateral Pipeline Water Crossing Summary Table

Fairbanks Lateral		Perennial			Intermittent			Artificial Path[a]			
Segment	Watershed	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	Open-Cut	Existing Bridge	HDD	New Bridge
Fairbanks Lateral	Tolovana	20	0	0	0	0	0	0	0	0	0
Total		20	0	0	0	0	0	0	0	0	0

[a] According to the USGS National Hydrological Dataset Metadata, an Artificial Path is a feature that represents flow through a 2-dimensional feature, such as a lake or a double-banked stream.

HDD = Horizontal Directional Drilling.

Source: AGDC 2010.

Construction

Construction of the GCF would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific locations of waterbody crossings for the access road development to the GCF[5] have not been determined. The area is primarily wetland habitat within the Arctic Coastal Plain and is discussed in detail in Section 5.4, Wetlands. The expected effect of the GCF facility on flood storage capacity would be negligible. Water use from local reservoirs for construction of the facility would occur, but would not likely cause adverse effects and would require permitting. The construction activities are not expected to cause adverse impacts to water resources beyond what is mentioned in Section 5.4, Wetlands.

Operations and Maintenance

The GCF would have onsite hazardous substances such as lubricants, cleaners, and fuels. There is a potential for spills and leaks to occur on the roads and pads (including Natural Gas Liquids [NGLs] and H_2S) which could runoff into the surface or groundwater. Risk would be mitigated by preparing and following the Spill Prevention Control and Countermeasure (SPCC) Plan. Regular vehicle use on roads and pads could potentially leak lubricants and toxic substances over the long term which could contaminate the surrounding surface waters. This would be incremental contaminant exposure over time which would accumulate in surrounding waterbodies. In addition, it is unknown what amount of water would be required for regular operations of the GCF. New reservoirs and lakes in the area may be utilized for additional consumption of existing water sources.

The GCF would be located in the Arctic Coastal Plain, where permafrost is continuous, and may contribute to thawing of the permafrost. In addition, warming of the ground may alter groundwater and surface water flow characteristics (IPCC 1997). These facilities would be built on gravel pads that will help insulate the permafrost and minimize thawing. However, as noted in Section 5.3, Terrestrial Vegetation, fugitive dust created from vehicle use can cause accelerated thaw of ice and snow along roadsides, and thermokarst development.

Compressor Stations

Besides the compressor facilities that will be collocated with other aboveground facilities, there would be either one additional compressor station (CS) located at about MP 285.6, or two additional compressor stations, one at MP 225.1 and one at MP 458.1. The compressor station locations are shown in Figure 2.1-1. The compressor stations would each be constructed on a gravel pad. The design would be site-specific, but is anticipated to be 1.5 acres minimum. The AGDC intends to request 20 acres of ROW each to accommodate variations from typical layout (except for the CS that would be collocated with the straddle and off-take facility). A new permanent gravel access road would be needed for each station.

Construction

[5] As described in Section 2.1.3.3.5 the proposed Project mainline construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the proposed Project ROW. Ninety permanent gravel roads of which 60 would be new, would be required for proposed Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

Construction of a compressor station at CS-4 would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific information on waterbody crossings is not available for the access roads to the CS-4[6]. The station would be located near the Middle Fork Koyukuk River in between the Wolf Pup and Sheep Creek Drainages. There is no peak stream flow data from any USGS stream gauge nearby. However, based on a review of a USGS map, the station would be well above the normal stages of the Middle Fork Koyukuk River, and does not appear to be encroaching on Wolf Pup or Sheep Creek. There is no reason to believe CS-4 would affect flood storage or be in a floodplain.

Based on available data, construction of a compressor station at CS-5 would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific information on waterbody crossings for the access road to the CS-5 is unavailable. The station would be located near Jim River and an unnamed drainage flowing into Jim River, north of Prospect Creek. There is no high water information from a USGS stream gauge nearby. However, based on a review of a USGS map, the station would be about 1 mile away from the Jim River and over a half mile from Prospect Creek, and does not appear to be encroaching on unnamed drainages. There is no reason to believe CS-5 would affect flood storage or be in a floodplain.

Construction of a compressor station at CS-8 (collocated with straddle and off-take facility) would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. The AGDC did not provide specific GIS data on waterbody crossings for the access road to the CS-8. The station would be located near Goldstream Creek. There is no peak stream flow information from a USGS stream gauge nearby. However, based on a review of a USGS map, the station would be a quarter mile away from and well above the normal stage of Goldstream Creek. There is no reason to believe CS-8 would affect flood storage or be in a floodplain.

The potential impacts to water resources that may occur when constructing the CS's are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities. None of the construction activities are expected to cause long term adverse impacts to water resources.

Operations and Maintenance

The compressor stations could have onsite hazardous substances such as lubricants, cleaners, and fuels. Potentially hazardous materials would be stored and labeled appropriately under OSHA requirements. The AGDC would dispose of hazardous and non-hazardous waste as required under regulations and permits for waste handling. This information will be included in a Comprehensive Waste Management Plan (CWMP), Spill Prevention Control Plan (SPCP), and a Spill Prevention Control and Countermeasure Plan (SPCCP). Spills or leakage of hazardous substances into the surface or groundwater would be unlikely and risk would be mitigated by

[6] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

these plans. Impacts noted above under the GCF would apply to operations and maintenance activities of the compressor stations.

Straddle and Off-Take Facility

The straddle and off-take facility and new permanent gravel access road would be located on a 35-acre gravel pad at between MP 461.0 and 466.5. The proposed straddle and off-take facility location is shown in Figure 2.1-4.

Construction

Based on available data, construction of the straddle and off-take facility (collocated with CS-8 if CS-8 is built) would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific stream crossings for the access road to the straddle and off-take facility[7] is not been provided. The facility would be located near Goldstream Creek, and there is no peak stream flow information from any USGS stream gauge nearby. However, based on a review of a USGS map, the facility would be a quarter of a mile away from and well above normal stage of Goldstream Creek. There is no reason to believe CS-8 would affect flood storage or be in a floodplain.

The potential impacts to water resources that may occur when constructing the straddle and off-take facility are the same as noted above under Compressor Station construction. None of the construction activities are expected to cause substantial impacts, and would be temporary and localized. Disturbance to ground cover would occur within the construction ROW and is expected to be negligible since the AGDC would be required to follow an Erosion Control Plan.

Operations and Maintenance

The straddle and off-take facility would produce similar potential impacts as what would be expected for the GCF and CS noted above.

Cook Inlet NGLEP Facility

The Cook Inlet NGL Extraction Plant (NGLEP) Facility and Pipeline Terminus would be located at the south terminus of the pipeline, at MP 737, on a 70 acre gravel pad. The Cook Inlet NGLEP Facility and Pipeline End location is shown in Figure 2.1-5.

Construction

Construction of the Cook Inlet NGLEP Facility and Pipeline Terminus, would not require excavation in a stream or river, HDD, or require fill in a FEMA-mapped floodplain. Specific GIS data on waterbody crossings for the access road to the Cook Inlet NGLEP Facility and Pipeline

[7] As described in Section 2.1.3.3.5 the proposed Project mainline construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the proposed Project ROW. Ninety permanent gravel roads of which 60 would be new, would be required for proposed Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

End[8] have not been provided. The station would be located south of an unnamed stream contributing to the Little Susitna River. There is no high flow information from a USGS stream gauge nearby. However, based on a review of a USGS map, the location is low-lying and marshy. Therefore, it is possible it is in the 100-year floodplain.

The potential impacts to water resources that may occur when constructing the Cook Inlet NGLEP Facility are: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities.

Operations and Maintenance

The Cook Inlet NGLEP Facility would have onsite hazardous substances such as lubricants, cleaners, and fuels. There is a possibility of spills or leakage of hazardous substances into the surface or groundwater; however, risk would be mitigated by preparing and following the SPCC plan. Impacts noted above under the GCF, CS and straddle and off-take facility would apply to operations and maintenance activities of the Cook Inlet NGLEP Facility.

Mainline Valves and Pig Launcher/Receivers

Mainline valves (MLVs) would be located every 20 miles along the mainline pipeline, for a total of about 37 block valves on the mainline and two on the Fairbanks lateral for a total of 32 (AGDC 2010). The purpose of the block valves is to restrict or stop flow for safety, maintenance, or operations. They would be installed on reinforced concrete pads on a compacted subgrade. Access would be provided by permanent workpads or construction access roads (AGDC 2010). As described in Section 2, Project Description, pig launcher/receivers would be located at all major aboveground facilities: the GCF, straddle and off-take facility, Cook Inlet NGLEP Facility, compressor stations, and Fairbanks Lateral.

Construction

Construction of the block valves would not require excavation in a waterway, HDD, or require fill in a FEMA-mapped floodplain. Specific GIS data on waterbody crossings for the access road to the MLVs and pig launcher/receivers[9] has not been provided. No further analysis on potential flood storage capacity or flood risk was conducted, as specific locations were not provided. None of the construction activities noted above are expected to cause adverse impacts to water resources. Some of the potential impacts could include: permanent and temporary disturbance to ground cover, erosion and compaction of soils reducing permeability, contamination from heavy equipment use and storage, and use of water for construction activities.

Operations and Maintenance

[8] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

[9] As described in Section 2.1.3.3.5 the proposed mainline Project construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project right-of-way. Ninety permanent gravel roads, of which 60 would be new, would be required for Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

The block valves are not expected to have adverse impacts on surface water, groundwater, or floodplains beyond what has been noted above for operational and maintenance activities for compressor stations.

Support Facilities

Operations and Maintenance Buildings

Operational facilities would be located in Prudhoe Bay, Fairbanks, and Wasilla (AGDC 2011d). It is assumed that existing infrastructure would be used to support these operations and additional impacts to water resources would be minimal.

Construction Camps, Pipeline Yards, and Logistics Sites

The proposed Project would require 15 temporary construction camps, pipe laydown yards, the Seward Logistics Site, and the Fairbanks Logistics Site. The total acreage of all construction camps, laydown yards, and logistics sites would be 178 acres. With the exception of two construction camps (one at Chulitna Butte and one at Sunshine), the construction camps would all be located on previously disturbed land. Pipeline laydown yards would be used temporarily to store pipe and materials for the construction phase of the proposed Project. Dimensions of sites would depend on the site and the type and amount of material to be stored (AGDC 2011d). Due to utilizing existing disturbed sites, potential impacts would be minimal and temporary for water resources.

Use and Storage of Construction Equipment

Construction

Use and storage of construction equipment may result in small petrochemical leaks that affect surface water quality or groundwater quality. Mitigation measures include developing and following a Spill Prevention and Control Plan (SPCP) that follows all regulations and uses for BMPs; for example, using drip pans under vehicles when parked. The potential impact for contamination to reach surface and ground waters would be temporary and localized during the construction phase of the proposed Project.

Development of construction camps, laydown yards, and logistics sites will not require excavation in a waterway, or HDD. Locations of these waterbody crossings for access road development to the construction camps, laydown yards, and logistics sites[10] have not been provided. None of these activities are expected to cause adverse impacts to water resources; however, as noted above petrochemical leaks would likely occur and runoff into drainages altering water quality. Disturbance to ground cover outside the construction ROW may occur for these uses. An Erosion Control Plan would be adhered to in order to comply with mitigation measures.

[10] As described in Section 2.1.3.3.5, the proposed Project mainline construction would require the temporary use of 40 gravel and ice roads, 12 of which are existing roads, to access the Project ROW. Ninety permanent gravel roads, of which 60 would be new would be required for proposed Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral.

Operations and Maintenance

Water resources would be required to operate the construction camps as living facilities for construction workers and logistics centers. Water use at these facilities would not be expected to adversely affect water resources; however, would be site dependant on available sources and consumption dependant.

Material Sites

Construction of the pipeline would require sand and gravel for construction activities from borrow areas. Existing material sites are distributed along the pipeline route from the TAPS development (AGDC 2010). Approximately 546 existing sites have been identified by the AGDC, but there are a few areas (Minto Flats and south of Willow) which have no developed sites (AGDC 2011d), new sites may be developed. New material sites may require new access roads - plans will be developed for agency approval prior to development. Excavation of borrow material may result in increased sediment loading of surface water due to erosion during runoff events if the borrow pit was near the waterbody. A borrow pit can also become a new source of groundwater recharge during ice break-up or groundwater discharge during the summer through evaporation, as it fills with water over time.

Storage of Sand and Gravel Materials

Construction

Construction activities may potentially impact water resources that may occur where new material sites are developed. Impacts include: temporary and permanent disturbance of ground cover, use of heavy equipment, excavation of borrow areas, use and storage of construction equipment, storage of sand and gravel, and use of water for construction activities (dust control). Storage of sand and gravel materials may result in increased sedimentation of surface water or a reduction in flood storage capacity, if located within a floodplain. These affects would be minimal, localized and temporary during the construction phase of the proposed Project.

Operations and Maintenance

The sand and gravel storage sites are not expected to have any operational and maintenance impacts to surface water, groundwater, or floodplains.

Stream Crossing and Associated Potential Impacts to Water Resources

Buried Pipeline

The burial of the pipeline would primarily include trenches or berms (AGDC 2011d). If the pipeline is placed in an aboveground berm, located within a floodplain, this may result in a reduction in flood storage capacity or restrict flow causing backwater effects upstream. Streambeds, streambanks, and riparian areas would be restored to pre-development contours and configurations to the maximum extent possible. Streambanks and riparian area would be re-vegetated to prevent erosion and to maintain streambank stability (AGDC 2011d). Therefore, the buried pipeline would not be expected to cause long-term effects on stream flow, stream profile, or structural components of streams or surface waterbodies (AGDC 2011d) (Table 5.2-27).

Unburied Pipeline

The unburied pipeline segments would not likely have adverse impacts on surface water, groundwater, or floodplains (Table 5.2-27). However, in the first 6 miles of the pipeline in Prudhoe Bay, the vertical support members (VSMs) may cause surface water to accumulate and pool due to the potential for permafrost to melt around the VSMs. This can be observed around some of the existing VSMs supporting pipelines within the Prudhoe Bay area.

Excavation in a Waterbody

Construction through a waterbody could have moderate impacts on water resources, dependant on the construction season, method used, and mitigation measures for the proposed Project. Construction during the winter when the ground is frozen would have substantially fewer impacts on water resources versus during the summer construction season. The construction duration across a waterbody (stream) would occur over 1 to 3 days.

Disturbance to Ground Cover

Disturbance to ground cover may result in increased sediment loading in surface water due to erosion during runoff events; or from soil exposure from wind processes. The AGDC would use erosion control procedures as provided in their Sediment and Erosion Control Plan and Storm Water Pollution Prevention Plan (SWPPP). Normal drainage would be maintained where practical (ADGC 2011). Areas sensitive to erosion would be identified during detailed engineering (ADGC 2011). With mitigation measures in place, impacts to surface water due to disturbance to ground cover are expected to be moderate and temporary (Table 5.2-27). During the post-construction phase, revegetation of disturbed areas would reduce sedimentation into surface waters as plants become established (Section 5.3, Terrestrial Vegetation).

TABLE 5.2-26 Water Resource Impacts of the Proposed Project with Mitigation Measures in Place

Activity	Surface Water	Groundwater	Floodplain	*Significant*	*Moderate*	*Negligible*	*No Effect*
Buried Pipeline	•	•	•			•	
Unburied Pipeline							•
New Bridges							•
Permanent Aboveground Facilities	•	•	•			•	
Surface and Groundwater Use	•	•				•	

TABLE 5.2-27 Construction Impacts to Water Resources of the Proposed Project with Mitigation Measures in Place

Activity	Surface Water	Groundwater	Floodplain	Temporary	Permanent	*Significant*	*Moderate*	*Negligible*	*No Effect*
Excavation in Water Body	•	•		•			•		

Temporary Restrictions to Flow	•		•	•				•	
Disturbance of Ground Cover	•			•			•		
HDD	•	•		•					•
Use of Heavy Equipment	•	•	•	•	•		•		
Excavation of Borrow Areas	•	•	•	•	•		•		
Use and Storage of Construction Equipment	•	•		•				•	
Storage of Sand and Gravel Materials	•		•	•				•	
Placement of Fill for Pipeline or Aboveground Facility	•		•	•	•			•	
Use of Surface Water for Construction Activities	•	•		•			•		
Disturbance of Contaminated Sites	•	•		•	•			•	

Use of Heavy Construction Equipment

Heavy equipment use at pipeline installation locations and staging areas may result in altered surface water flow and availability due to soil compaction. This may also result in increased surface water runoff and the potential for flooding due to reduced soil permeability. Surface water drainage patterns should return to pre-construction conditions, but there is a possibility that soil compaction could permanently alter surface water flow in the footprint of the proposed Project (Table 5.2-27). There could be permanent alterations to surface water runoff characteristics at permanent aboveground facilities; this is discussed under Operational Impacts.

Placement of Fill in Floodplain for Pipeline or Aboveground Facility Installation

Placement of fill for the pipeline trench or aboveground facility installation may result in a reduction in flood storage capacity (if within a floodplain). This may cause increased upstream sedimentation due to backwater effects. Short term disturbance will be limited to construction impacts (AGDC 2010). Construction of the proposed Project is not expected to cause long-term effects (Table 5.2-27) on stream flow, stream profile, or structural components of streams or waterbodies (AGDC 2010).

Permanent Aboveground Facilities

Aboveground facilities may store hazardous substances that could contaminate surface water or groundwater from a spill. The AGDC would develop and follow several plans (CWMP, SPCP, and SPCCP) to minimize the potential for a spill. If aboveground facilities were located within a floodplain, the result could reduce flood storage capacity, or flow restriction causing increased upstream stages due to backwater effects. Contamination from hazardous liquids from vehicle use on facility pads could contaminate surface waters from run-off. Surface water runoff may increase due to reduced permeability from soil compaction and impermeable surfaces.

Surface and Groundwater Use

Surface water will be used for hydrostatic testing to test the pipeline for leaks (Table 5.2-22). Surface water use for operation and maintenance activities may result in alteration of surface water quantity, quality and hydraulics for fluvial systems. Water use from lakes, may result in reduced water volumes which may impact fish and aquatic species (Table 5.2-22). Groundwater use may result in similar results in reduced water quality from sedimentation, quantity from lack of recharge or production of a new groundwater discharge area.

Disturbance to Contaminated Sites

Construction of the pipeline or associated facilities may cause disturbance of contaminated sites, which could result in additional groundwater and soil contamination. The AGDC has committed to avoiding known contaminated site areas for construction purposes. Additional mitigation requirements include investigating the contaminated sites further to determine full extent and type of contamination and either cleaning them up or avoid them altogether. Implementation of these additional mitigation measures would reduce the impact on soils and groundwater to a negligible level of significance (Table 5.2-27).

5.2.2.3 Denali National Park Route Variation

The Denali National Park Route Variation would be located to the west of the mainline pipeline route starting at MP 539 (Figure 4.4-2), approximately 10 miles south of Healy passing through the Denali National Park and Preserve. The Denali National Park Route Variation is shown with the water resources for the proposed Project area in Figure 1.1-1 and in Figure 5.2-1. There are two major river crossings proposed for this route variation: an existing pedestrian/bike bridge south of the Canyon commercial area and a buried crossing (HDD method) in the Nenana River south of the McKinley Village (ENSTAR 2008).

Construction

The Denali National Park Route Variation construction impacts would include crossing the Nenana River two times (Table 5.2-24). The Denali National Park Route Variation would be associated with existing utility corridors. It would utilize the existing pedestrian bridge at the lower crossing and HDD to bury the pipeline at the south end (upper crossing). HDD methods would potentially cause impacts as noted above under HDD. Stringing the pipeline aerially across the Nenana River at the lower crossing would not be expected to cause additional impacts to water resources because of the use of the existing pedestrian bridge. Removal of vegetation along steep slopes for ROW construction could have the potential to increase sedimentation into waterways from erosion.

The Mainline Route from MP 540 to MP 555 proposes to cross 6 drainages (Montana, Yanert, Carlo and 3 other unnamed drainages) via open-cut methods (AGDC 2011d) (Table 5.2-24). Construction in these drainages would result in potentially short-term or long-term impacts as noted above under open-cut methods. Final pipeline crossing location and stream crossing methods will be determined later in the planning process as part of the permitting requirements of the proposed Project.

Operations and Maintenance

It is unlikely that adverse impacts would occur to water resources from operation and maintenance of either the Denali National Park Route Variation or the Mainline Route. The potential exists for operation of the Mainline Route to impact water resources at stream crossings via the pipeline temperature operating at a cooler temperature than the surrounding subsurface temperature. The AGDC plans to mitigate for this by operating the pipeline at a temperature that would match the surrounding subsurface temperature at ambient conditions.

5.2.3 References

ADEC. See Alaska Department of Environmental Conservation.

ADNR. See Alaska Department of Natural Resources.

AGDC. See Alaska Gasline Development Corporation.

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5.3 TERRESTRIAL VEGETATION

This section describes the ecoregions and terrestrial vegetation communities identified within a 10-mile-wide corridor along the proposed 737-mile proposed Project right-of-way (ROW). It includes the Fairbanks Lateral, aboveground facilities, and extra work areas outside the ROW, and the Denali National Park Route Variation. The AGDC has proposed mitigation measures to reduce impacts to terrestrial vegetation, which is included in Section 5.23.2.3.

5.3.1 Affected Environment

The proposed Project would cross a diverse array of vegetation communities extending from the Arctic coastal plain to the Cook Inlet Basin in Southcentral Alaska. The following discussion includes a broad perspective based on the ecoregions present along the proposed route, with detailed descriptions of the vegetation communities (land cover types) within a 10-mile-wide corridor.

5.3.1.1 Ecoregions

Each ecoregion includes a complex of terrestrial and wetland vegetation types. The distribution and extent of which are strongly influenced by elevation, soil characteristics, temperature, and moisture. General descriptions of the vegetation and wetland communities within each ecoregion crossed by the proposed Project are derived from Nowacki et al. (2001), Viereck et al. (1992), and the Trans-Alaska Pipeline System (TAPS) ROW Renewal FEIS (BLM 2002).

Nine ecoregions would be crossed by the proposed Project. Table 5.3-1 includes the ecoregion traversed by each segment of the ROW. A description of each ecoregion is included below.

Beaufort Coastal Plain Ecoregion

The Beaufort Coastal Plain ecoregion is a windy and treeless plain, which progressively ascends from the Beaufort Sea coast southward to the foothills of the Brooks Range. A dry, polar climate dominates this flat to rolling landscape. Permafrost is continuous across the area, except under large rivers and thaw lakes. The prevalence of thaw lakes and saturated soils results in wetland plant communities characterized by sedges, grasses, and mosses as the predominant vegetation features. Small areas of wet tundra occur in shallow water and primarily support wet sedge meadow tundra and wet sedge-grass meadow community types (Walker et al. 1980; Walker and Acevedo 1987). Sites with deeper water (up to 3 feet), typically support grass marsh communities (BLM 2002).

In locations of increased surface elevation, vegetation communities support dwarf shrubs, cushion plants, lichens, and graminoid plants (grasses and grass-like plants) that are adapted to the better-drained soils (Walker 1985). Tussock tundra, characterized by tussock cottongrass (*Eriophorum spp.*), occurs within more moist locations with decreased surface elevation. These sedges are generally 4 to 24 inches tall and often are interspersed with low shrubs much shorter than the sedges (Viereck et al. 1992).

TABLE 5.3-1 Ecoregions Crossed by Project Segment

Project Segment	Unified Ecoregion of Alaska	Level II Ecoregion	Mainline MP Start	Mainline MP End
GCF to MP 540	Beaufort Coastal Plain	Arctic Tundra	0.0	63.7
	Brooks Foothills	Arctic Tundra	63.7	147.8
	Brooks Range	Arctic Tundra	147.8	256.3
	Kobuk Ridges and Valleys	Intermontane Boreal	256.3	261.4
	Ray Mountains	Intermontane Boreal	261.4	432.7
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	432.7	446.2
	Yukon-Tanana Uplands	Intermontane Boreal	446.2	450
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	450.0	452.2
	Yukon-Tanana Uplands	Intermontane Boreal	452.2	462.8
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	462.8	466.2
GCF to MP 540 / Fairbanks Lateral	Yukon-Tanana Uplands	Intermontane Boreal	466.2	466.5
GCF to MP 540	Tanana-Kuskokwim Lowlands	Intermontane Boreal	466.5	519.3
GCF to MP 540 / MP 540 to MP 555 / Denali National Park Route Variation	Alaska Range	Alaska Range Transition	519.3	616.2
MP 555 to End	Cook Inlet Basin	Alaska Range Transition	616.2	736.4

Source: Nowacki et al. (2001); Viereck et al. (1992); BLM 2002

Dry tundra community types occur on well-drained soils such as the margins of old lake basins and rivers, and on soils formed from stream gravel deposits. These communities are predominantly sedge-*Dryas* tundra and *Dryas* dwarf shrub tundra (Walker 1985). Dwarf shrubs characterize the latter community type, less than 8 inches tall, primarily species of *Dryas* (Viereck et al. 1992). *Arctophila fulva* is a common and important wetland species in this ecoregion, and is discussed in detail in Section 5.4, Wetlands.

Brooks Foothills Ecoregion

The Brooks Foothills ecoregion primarily consists of broad exposed ridges and gently rolling hills that create the northern flank of the Brooks Range. Within these long, linear ridges and buttes are narrow alluvial valleys, glacial moraines, and outwash plains. Most of the surface is covered with colluvial and eolian deposits. The ecoregion has a dry polar climate that is warmer and wetter than the Beaufort Coastal Plain. Continuous permafrost under the surface inhibits drainage, and leads to saturated soils and a predominance of wetland vegetation communities. Vegetation is dominated by vast expanses of mixed shrub-sedge tussock tundra, interspersed with willow thickets along rivers and small drainages and *Dryas* tundra on ridges. Calcareous areas are found along the lower foothills, which support sedge-*Dryas* tundra (Nowacki et al. 2001).

The most common vegetation type of the foothills is tussock tundra, which predominates on old glacial moraines. Dwarf shrub communities occur on rocky moraine ridges. Active floodplains and small drainages support willow and alder shrub communities. Inactive floodplains support extensive wet sedge meadows (Viereck et al. 1992).

Uplands occur on south-facing sandstone outcrops and on exposed till. However, most low-lying areas support wetlands. The valley bottoms and hill slopes have poorly drained soils with thick organic layers (Walker et al. 1989). Silty soils, particularly on upper slopes, are thick enough to impede surface water drainage and remain saturated. Wetland plant communities of the northern foothills include tussock tundra, open low mixed shrub-sedge tussock tundra, open low mesic shrub birch ericaceous shrub, open low willow shrub, and wet sedge meadow tundra.

Brooks Range Ecoregion

The Brooks Range ecoregion contains the east-west trending Brooks Mountain Range. The high, central component contains steep angular summits covered with rubble and scree, while the eastern and western sections have less rugged topography with fast-moving streams and rivers. The region has a dry polar climate with short, cool summers and long, cold winters. Alpine tundra is prevalent at higher elevations, while valleys have some needle-leaf and broadleaf forests.

The most common plant communities on the upper slopes and ridges are ericaceous dwarf shrub tundra, *Dryas*-sedge dwarf shrub tundra, and *Dryas* dwarf shrub tundra on the more exposed sites. These communities occur on well-drained soils and are dominated by shrubs less than 8 inches tall. Taller shrubs, if present, are relatively sparse, and the herbaceous species typically exceed the shrubs in height (Viereck et al. 1992). Trees are generally absent. Pond margins and stream banks support open low willow-sedge shrub tundra, with shrubs commonly 8 to 20 inches tall and few, if any, trees. Wet sedge meadow tundra communities are generally found within drained lake basins and valley depressions (Cooper 1986).

Much of the vegetation is located in or along floodplains. Floodplain vegetation communities on river terraces are typically open low alder-willow shrub communities and trees are generally absent or scarce (Viereck et al. 1992). On the south side of the Brooks Range, lower mountain slopes and valleys support sedge tussocks and shrubs. The Arctic tree line is restricted to the south side of the range. Here, sparse conifer-birch forests and tall shrublands occur in the larger valleys (Viereck et al. 1992).

Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valley ecoregion is comprised of a series of paralleling ridges and valleys that expand southward from the Brooks Range. Large, glacier-carved valleys contain large rivers that begin in the Brooks Range. The broad, U-shaped valleys are lined with both alluvial and glacial sediments, while the ridges are covered with rubble. Most of the area is underlain by thin to moderately thick permafrost. Long, cold winters and short, cool summers make up the dry continental climate that is prevalent in the area.

Vegetation communities include open spruce, and closed mixed forest mosaic and open and closed spruce forest. Forests and woodlands largely dominate, with black spruce in wetland bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on well-drained uplands. Tall and short shrublands of willow, birch, and alder communities occur on ridges. Trees become increasingly sparse, less robust, and restricted to lower elevations in the west where forests are slowly invading along rivers and streams (e.g., lower Noatak River) (Nowacki et al. 2001).

Ray Mountains Ecoregion

The Ray Mountains ecoregion comprises an overlapping series of compact ranges in an east-west direction. Bedrock is generally covered in rubble, resulting in shallow and rocky soils. Permafrost is largely discontinuous. The climate is continentally influenced, with dry, cold winters and relatively moist, warm summers.

The distribution of community types is influenced primarily by slope, aspect, elevation, parent material, and succession following wildfire (Viereck et al. 1986). Large differences in the vegetation of north- and south-facing slopes result from the dry continental climate and low sun angle. Vegetation distribution is also affected by the presence or absence of permafrost, which is often related to slope and aspect (Viereck et al. 1986).

The vegetation is dominated by black spruce woodlands, while white spruce, birch, and aspen are restricted to warm, south-facing slopes. White spruce, balsam poplar, alders, and willows dominate floodplains. Shrub birch and *Dryas*-lichen tundra prevail at higher elevations.

Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands ecoregion contains broad, rounded mountains of moderate height. Most surfaces are comprised of bedrock and coarse rubble on ridges, colluvium on lower slopes, and alluvium in the deeply incised, narrow valleys. The climate is strongly influenced by continental forces, generating warm summers and very cold winters. Discontinuous permafrost underlies north-facing slopes and valley bottoms.

Vegetation is dominated by white spruce, birch, and aspen on south-facing slopes, black spruce on north-facing slopes, and black spruce woodlands and tussock and scrub bogs in valley bottoms. Floodplains of headwater streams support white spruce, balsam poplar, alder, and willows. Above the treeline, low birch-ericaceous shrubs and *Dryas*-lichen tundra dominate. Forest fires, which influence vegetation composition and distribution, are frequent due to the high incidence of lightning strikes.

Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands ecoregion is an alluvial plain that slopes gradually northward from the Alaska Range. Soils are composed primarily of sediments of fluvial and glaciofluvial origin that are capped by varying thicknesses of eolian silts and organic soils. The climate is dry continental, characterized by cool summers and cold winters. Permafrost cover is thin and discontinuous.

Boreal forests dominate the landscape, with black spruce in bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on south-facing slopes. The coldest, wettest areas on permafrost flats support birch-ericaceous shrubs and sedge tussocks. Wet lowlands, where permafrost is near the surface, are the principal location for black spruce forests. Lowland areas with a shallow active layer over permafrost also support open black spruce-tamarack forest (Viereck 1975).

Alaska Range Ecoregion

The Alaska Range ecoregion is a mountain range comprised of a complex mix of folded, faulted, and deformed metamorphic rocks. Avalanches and landslides often move down the steep, scree-covered slopes. Discontinuous permafrost lies under shallow and rocky soils. Vegetation biomass is greatest on lower slopes, valley bottoms, and low elevation drainages.

The distribution of plant communities is primarily determined by slope and aspect. The soils of upper hillsides and ridge tops are shallow and gravelly. Vegetation on these well-drained, windswept, alpine sites consists of dwarf shrub communities. Slopes and drainages that are more protected support communities of dwarf and tall shrubs (BLM 2002). Lower slopes and valleys support open coniferous forests and woodlands consisting primarily of open white spruce forest or open black spruce-white spruce forest communities. Open white spruce forest occurs near the treeline and on inactive floodplains. Open black spruce-white spruce forest is generally restricted to areas near the treeline on north-facing slopes (Viereck et al. 1992).

Cook Inlet Basin Ecoregion

The Cook Inlet Basin ecoregion is a gradually sloping lowland, with fine-textured lacustrine deposits surrounded by lesser amounts of coarse-textured glacial tills and outwash. The basin contains numerous lakes, ponds, wetlands, and several meandering river systems. The area is generally permafrost free and climatically influenced by both maritime and continental forces, providing moderate fluctuations of seasonal temperature and abundant precipitation.

Vegetation communities in this ecoregion support black spruce forests and woodlands. Ericaceous shrubs are dominant in open bogs. Mixed forests of white and Sitka spruce, aspen, and birch grow on better-drained sites and grade into tall shrub communities of willow and alder on slopes along the periphery of the basin (Nowacki et al. 2001).

5.3.1.2 Ten-Mile-Wide Corridor

A 10-mile-wide corridor (5 miles on each side of the centerline) was used to provide a more detailed perspective of the vegetation communities present along the proposed Project. This information was derived from the 2001 National Land Cover Data (NLCD) (Homer et al. 2004). Due to the methods used to derive NLCD information, some vegetation characterizations may differ from actual field conditions (i.e., cleared ROW may be depicted as mixed forested areas).

A total of 18 land cover classifications are listed in Figure 5.3-1. Fifteen land cover types are found and summarized for the proposed route across three pipeline segments (MP 0 to MP 540, MP 540 to MP 555, and MP 555 to End), the Denali National Park Route Variation, and the Fairbanks Lateral. Wetland vegetation (woody wetlands and emergent herbaceous wetlands) are discussed thoroughly in Section 5.4 (Wetlands) and are not discussed further here. Perennial ice and snow is included in the maps for reference, but is not associated with the Project area. Terminology for vegetation follows the 2001 NLCD classification (Homer et al. 2004). Figure 5.3-1 (Maps 1-6) illustrates the 2001 NLCD composition of the 10-mile-wide corridor.

Project Segments

MP 0 to MP 540

The segment from MP 0 to MP 540 begins in the open water and sedge dominated vegetation community of the coastal plain southbound, to the dwarf scrub of the Brooks Range foothills. It then continues into the scrub/shrub and barren land of the Brooks Range before entering the intermontane boreal region of interior Alaska. Within this boreal region, the corridor increases in composition to evergreen forest, deciduous forest, and woody wetlands. This segment transitions into scrub/shrub and barren land of the Alaska Range. The entire corridor along this segment is composed of over 20 percent each of scrub/shrub and evergreen forest communities, with dwarf scrub and wetland vegetation comprising the less predominant vegetation covers (Figure 5.3-1, Maps 1-4). The Yukon River would be included in this segment of the proposed Project.

Fairbanks Lateral

The Fairbanks Lateral segment closely follows the Alaska Railroad Corporation (ARRC) ROW along Goldstream Creek (Figure 5.3-1, Map 4). Evergreen forests, deciduous forests, woody wetlands, and some mixed forests dominate this corridor.

MP 540 to MP 555

The MP 540 to MP 555 segment is comprised of similar vegetation communities within the Alaska Range (Figure 5.3-1, Map 4). The segment shows a prominence of evergreen forests, scrub/shrub vegetation, and barren land, and has over 30 percent evergreen forest and scrub/shrub, with barren land and dwarf scrub comprising a lesser quantity of vegetation cover.

Denali National Park Route Variation

The Denali National Park Route Variation is comprised of similar vegetation communities within the Alaska Range (Figure 5.3-1, Map 4). The route variation shows a prominence of evergreen forests, scrub/shrub vegetation, and barren land, with over 30 percent evergreen forest and scrub/shrub, with barren land and dwarf scrub comprising a lesser quantity of vegetation cover.

MP 555 to the END

The segment from MP 555 to the End traverses the remainder of the Alaska Range ecoregion and is dominated by scrub/shrub before it descends into the Cook Inlet Basin ecoregion (Figure 5.3-1, Maps 5 and 6). Within the Cook Inlet Basin, the corridor is composed of increasing amounts of deciduous forest, mixed forest, woody wetlands, and emergent herbaceous wetlands.

5.3.1.3 Non-native and Invasive Plants

Alaska has remained relatively free of the widespread invasion of non-native plants seen in the continental United States. However, controlling and prohibiting their introduction and proliferation are important management issues. The Alaska Natural Heritage Program (ANHP) (2011b) defines non-native and invasive plants as:

> *Non-native plants are plants that are present in a given area because of their accidental or intentional introduction by human activities.*
>
> *Invasive plants are non-native plants that produce viable offspring in large numbers and have the potential to establish and spread in natural areas.*

Not all non-native (exotic) species are invasive (noxious) plants that cause damage to natural ecosystems. Invasive species are a smaller proportion of non-native plants, which can cause economic and ecological damage by outcompeting native plants, reducing biological diversity, community structure and species composition. The ANHP, in cooperation with state and federal agencies currently tracks the distribution of 387 species of non-native plants in Alaska (ANHP 2012a). Documented locations of infestations obtained from plant surveys in Alaska are stored in the database, Alaska Exotic Plant Information Clearinghouse (AKEPIC), which is used for management purposes.

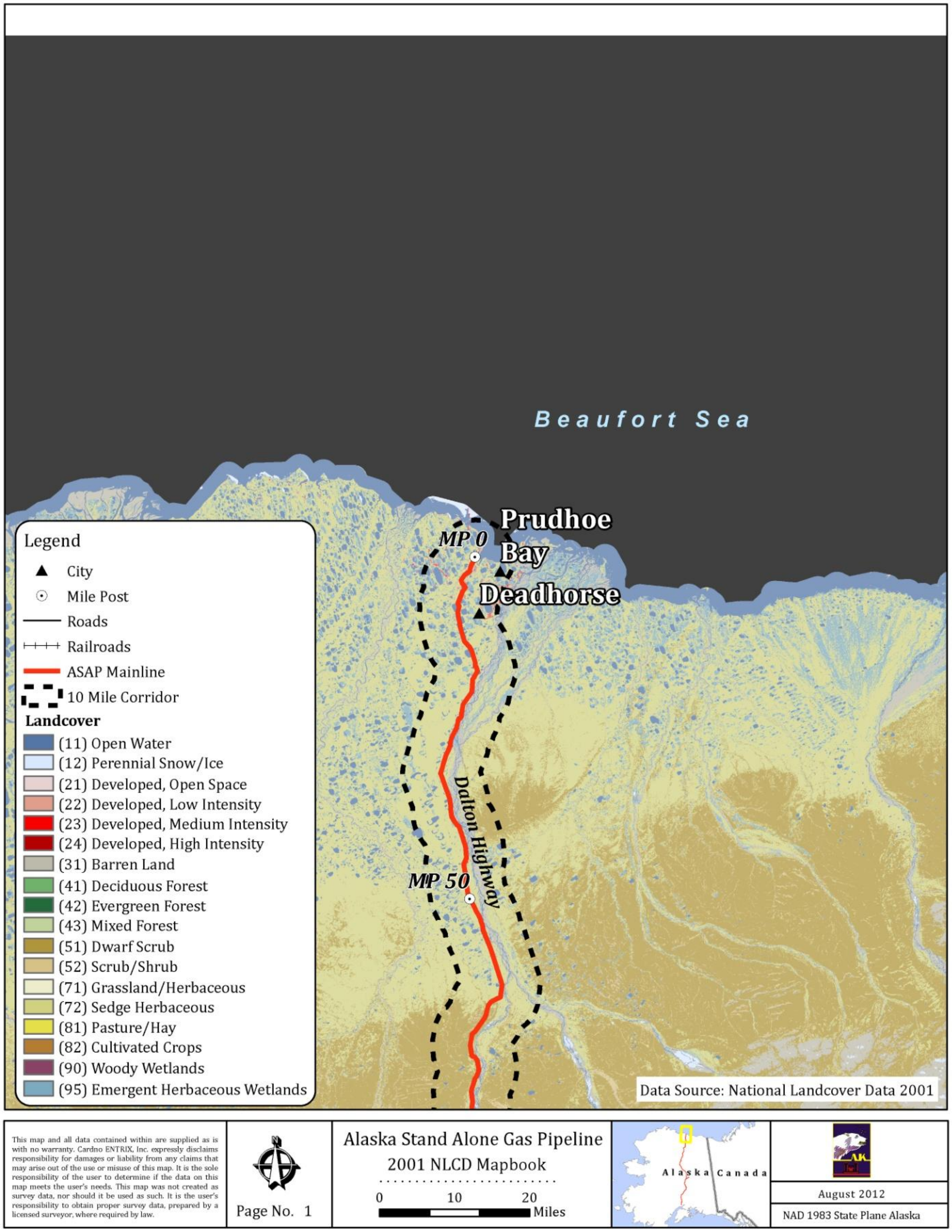

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 1)

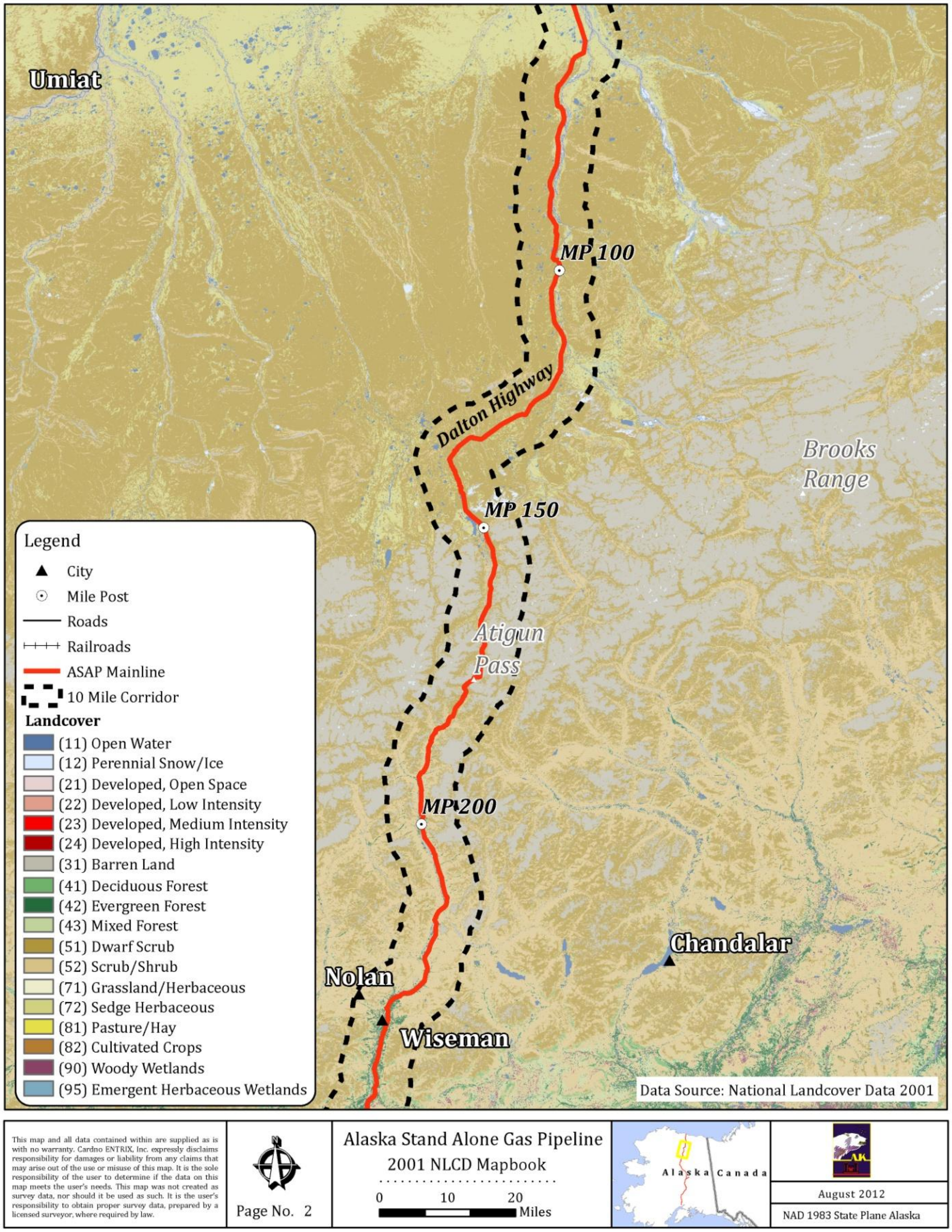

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 2)

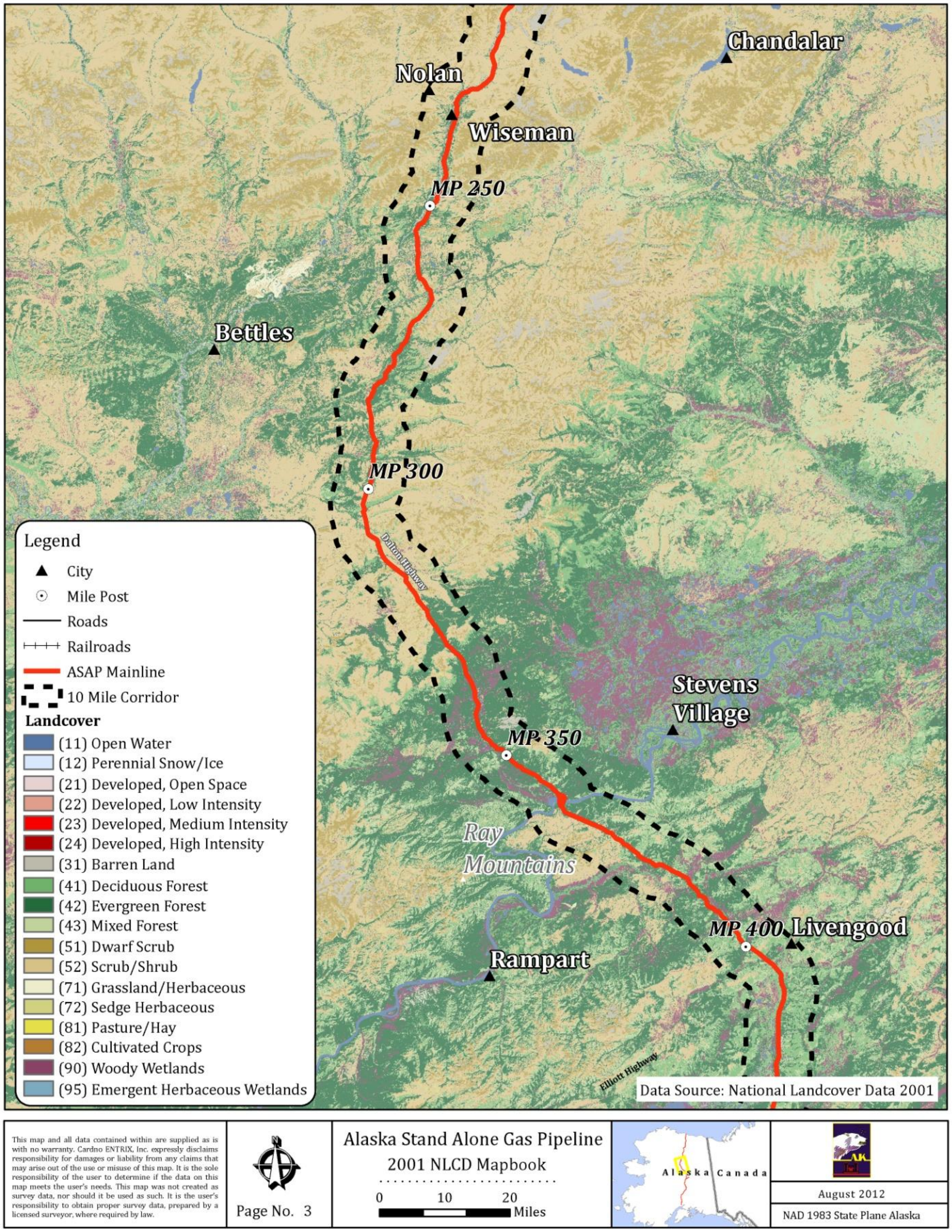

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 3)

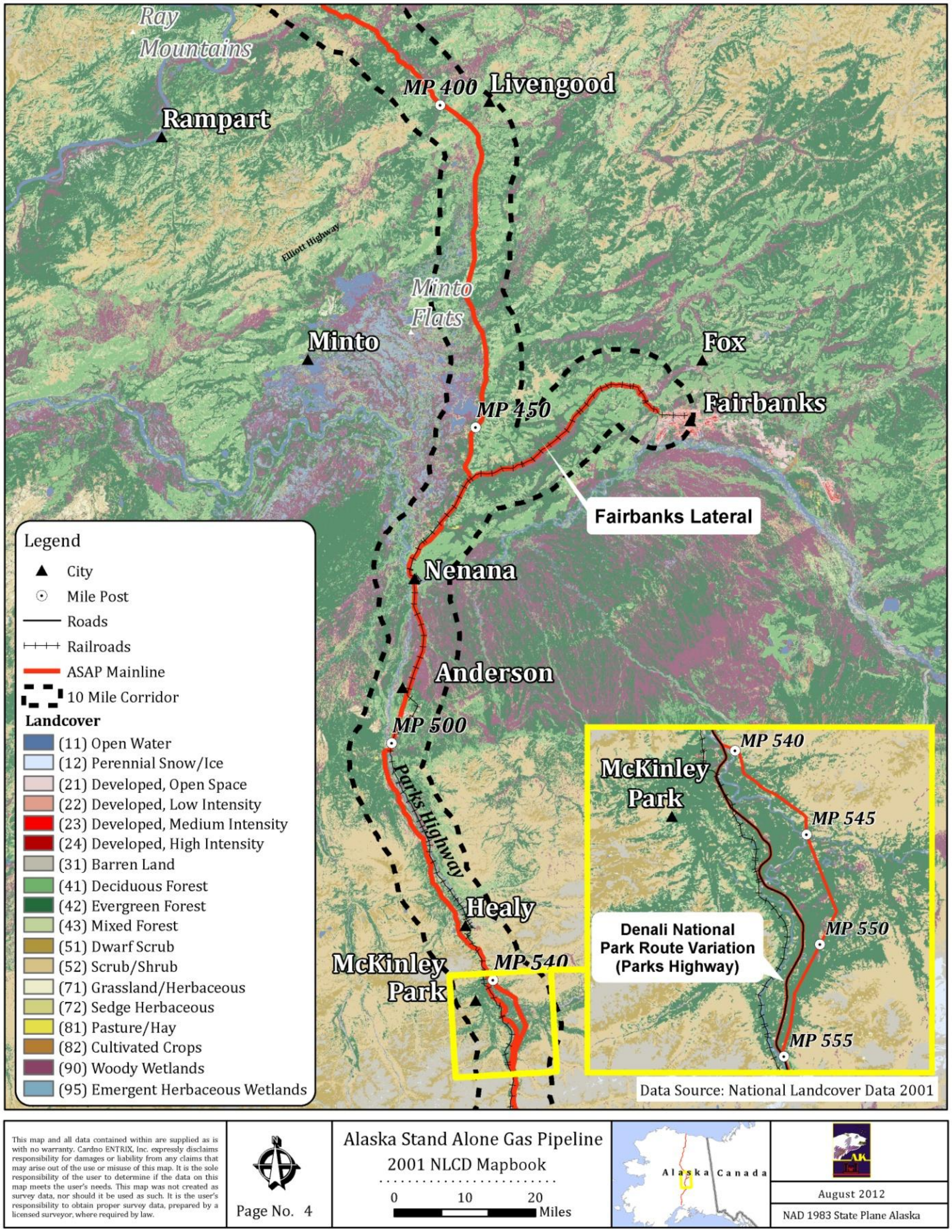

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 4)

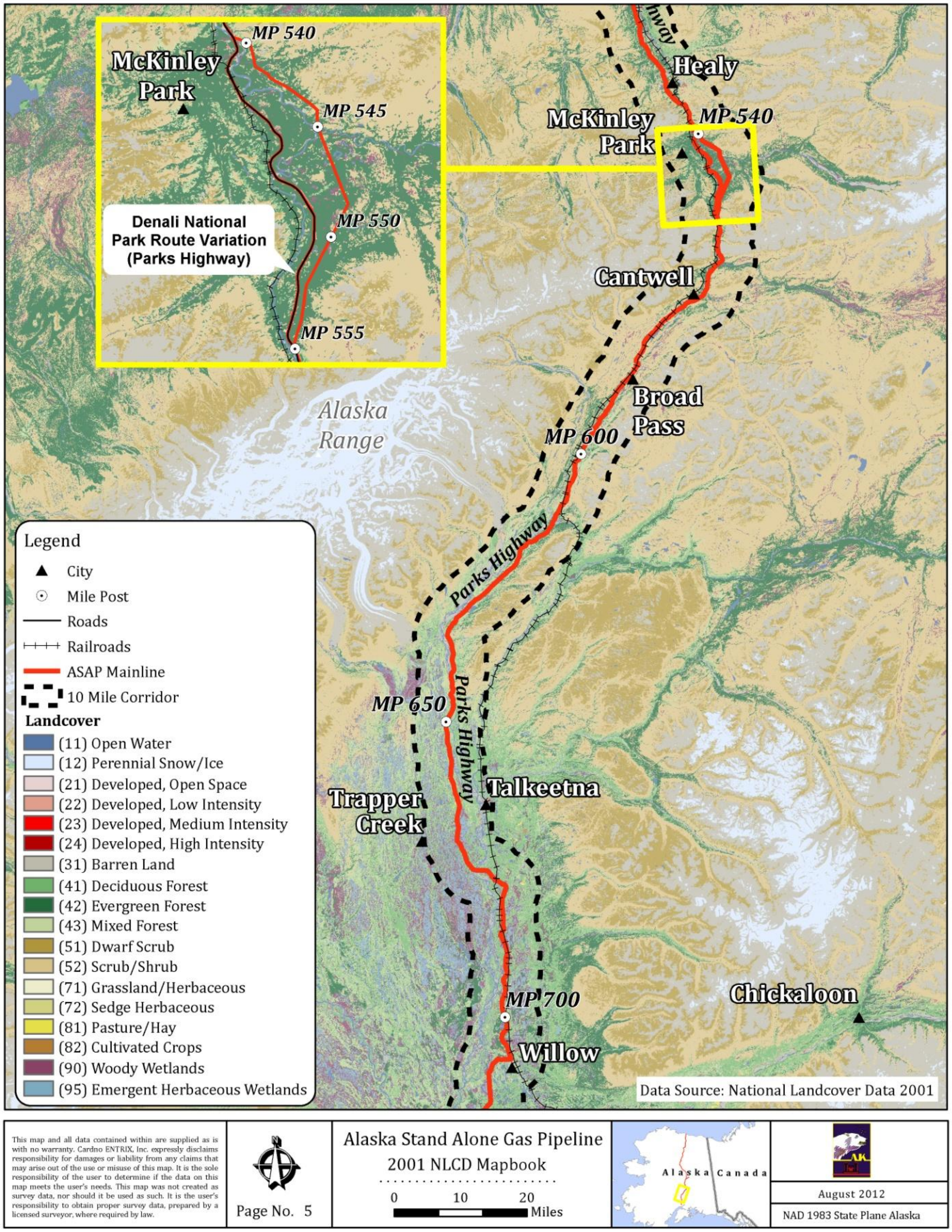

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 5)

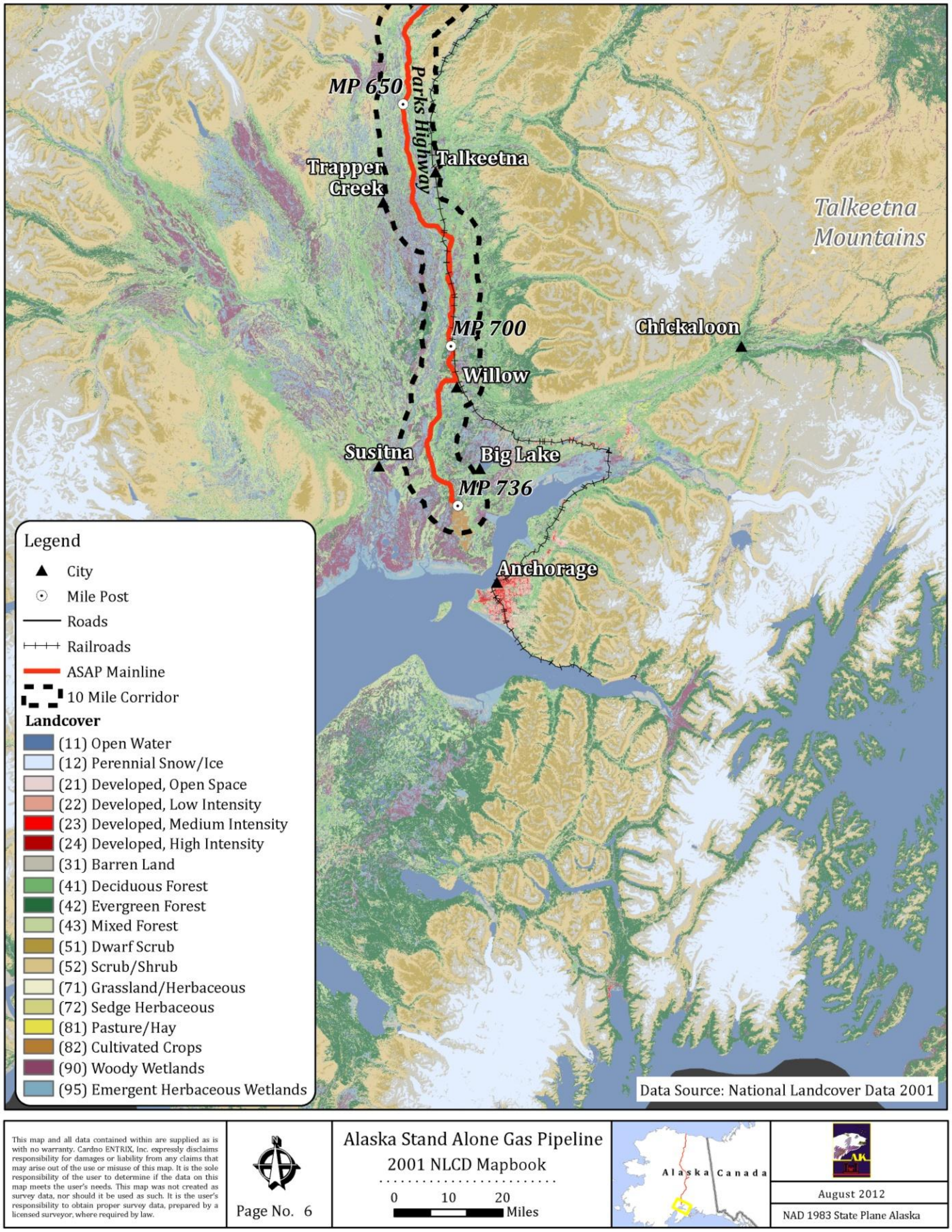

FIGURE 5.3-1 2001 NLCD Composition of the 10-Mile-Wide Corridor (Map 6)

The Alaska Department of Natural Resources (ADNR), Department of Agriculture (DOA) regulates noxious weed seed as prohibited or restricted in transport or sale within the State of Alaska (11 AAC 34). No person may plant in this state any agricultural, vegetable, tree, shrub, or flower seed containing any prohibited noxious weeds listed in 11 AAC 34.020(a) or any restricted noxious weeds in excess of the maximum allowable tolerances listed in 11 AAC 34.020(b) , except as provided in 11 AAC 34.030, without express written approval of the director. No person may use, sell, offer, expose for sale, give away, or transport for feeding, seeding, or mulching purposes any seed or grain screenings containing any prohibited noxious weed seed listed in 11 AAC 34.020(a) or any restricted noxious weeds in excess of the maximum allowable tolerances listed in 11 AAC 34.020(b), except as provided in 11 AAC 34.030, and except that the director may allow sale or transport of screenings.

A noxious weed is defined in the regulations (11 AAC 34.400) as any species of plant, either annual, biennial, or perennial, reproduced by seed, root, underground stem, or bulblet, which when established is or may become destructive and difficult to control by ordinary means of cultivation or other farm practices; or seed of such weeds that is considered commercially inseparable from agricultural or vegetable seed. Alaska regulations only prohibit movement of material containing prohibited noxious weeds. Restricted noxious weed seed are permissible for planting in Alaska up to the tolerance per pound established under 11 AAC 34.020(b). Nine plant species are listed as restricted noxious weeds and 14 species are listed as prohibited noxious weeds (ADNR 2010). The distinguishing factor between the two types is that restricted non-native weeds can be controlled by ordinary agricultural means, while prohibited non-native weeds cannot. Executive Order 13112 was issued to prevent the introduction of invasive species to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

A comprehensive survey of non-native plants has not been conducted along the entire proposed Project area. However, non-native plants are well documented along many road and utility corridors in Alaska (Lapina and Carlson 2004), especially the Dalton Highway (Cortes et al. 2008) and George Parks Highway corridors (ANHP 2011a). Along these corridors, non-native plant populations are frequently found in disturbed sites, including road construction and revegetation areas, parking lots, campgrounds, and Alaska Department of Transportation and Public Facilities (DOT&PF) stations (Cortes et al. 2008). Given the proposed Project and Denali National Park Route Variation's proximity to existing road and utility corridors along much of its alignment, it is likely that non-native plants exist within the corridor. The Denali National Park has been surveying and treating infestations of invasive plants in the park entrance area since the 1990's (NPS 2009).

5.3.1.4 Rare and Sensitive Plants

A summary of the federally protected and candidate species with the potential to occur in the proposed Project area is included in Section 5.8.3. However, there are no Endangered Species Act (ESA) listed or candidate plants within the proposed Project area to date. The Aleutian Shield Fern (*Polystichum aleuticum*), is currently the only listed plant in Alaska. A comprehensive survey of rare and sensitive plant species has not been conducted along the entire proposed Project route. The following section is intended to describe the potential for the occurrence of rare and sensitive plant species, not federally listed under the ESA along the proposed Project route.

A list of rare and sensitive plants was obtained from two sources, the Alaska Rare Plant List maintained by the ANHP (2012a) and the Bureau of Land Management (BLM) Alaska Sensitive Animal and Plant List (BLM 2010). Sensitive taxa are identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in populations or habitat (ANHP 2012a). The BLM defines a sensitive species as one in danger of rapidly dwindling to extinction, listing that species on the BLM Sensitive Species list (BLM 2010). The sensitive species designation is normally used for species that occur on BLM public lands and for which BLM has the capability to significantly affect the conservation status of the species through management (BLM 2010). These two lists were cross-referenced to produce a single list, presented in Table 5.3-2. The probability of occurrence along the proposed Project route was estimated from species range maps and rare plant inventories relevant to the proposed Project. Range maps from Hulten (1968) and the Alaska Rare Plant Guide (ANHP 2012b) were compared to the ecoregions traversed by the proposed Project. Results from Table 5.3-2 indicate that 23 rare and sensitive plants have the potential to occur along the Project corridor. In addition, area-specific plant inventories were also consulted to determine the potential occurrence of rare or sensitive plants. Specifically, the *Toolik Lake Research Natural Area/ACEC Rare Plant Inventory* (Carroll et al. 2002), *Rare Vascular Plant Species of the North Slope* (Carlson et al. 2006), and *The Vascular Plant Floristics of Denali National Park and Preserve, A Summary, including the Results of Plant Inventory Fieldwork 1998-2001* (Roland 2004) were referenced.

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants Along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Antennaria densifolia	Denseleaf pussytoes		✓			
Arnica lonchophylla	Northern arnica	H	✓			
Artemesia aleutica	Aleutian wormwood		♦	G1/S1	CAFF	FWS
Artemisia globularia ssp. *lutea*	Purple wormwood species		☒	G4T1/S1	CAFF	BLM, FWS, NPS, S?
Artemisia laciniata	Siberian wormwood	H	✓			
Artemisia senjavinensis	Arctic sage / Bering Sea wormwood		✓	G3/S2S3	CAFF	BLM, NPS, N, S?
Aster pygmaeus (Eurybia pygmaea)	Pygmy aster	M, TL	✓			
Beckwithia glacialis spp. Alaskensis [a]	Alaskan glacier buttercup	TL	♦	G4T2/S2	CAFF	S?
Botrychium ascendens	Upswept moonwort		☒	G3?/S1	S	FS, NPS

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants Along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Carex adelostoma	Circumpolar sedge		✓			
Claytonia arctica	Arctic springbeauty	TL	✓			
Claytonia ogilviensis	Ogilvie mountains springbeauty		☒	G1/SP		
Cochlearia sessilifolia	Sessile-leaved scurvy grass		♦	G1G2Q/S1S2		FWS
Cryptantha shackletteana	Shacklettes' catseye		☒	G1Q/S1		NPS, N, S?
Douglasia alaskana	Alaska rock-jasmine		✓			
Douglasia arctica	Mackenzie River Douglasia		✓			
Douglasia beringensis	Bering Sea douglasia / Arctic Dwarf Primrose		☒	G1/S1	CAFF	BLM, NPS, N, S?
Draba aleutica	Aleutian Whitlow-Grass		♦	G2G3/S2	CAFF	FWS, N
Draba kananaskis	Kananaskis Whitlow-Grass		♦	G1Q/S1	S	FS
Draba micropetala	Alpine Whitlow-grass	T	✓			
Draba murrayi	Murray's Whitlow-grass		☒	G2/S2		BLM, NPS, N, S?
Draba ogilviensis	Ogilvie Mountains Whitlow-grass		☒	G2G3/S1		NPS
Draba pauciflora	Adam's Whitlow-grass	C	✓			
Erigeron muirii	Muir's Fleabane	C, H, M, TL	☒	G2/S2	CAFF	BLM, FWS, NPS, N
Erigeron yukonensis	Yukon flea-bane		✓			
Eriogonum flavum var. *aquilinum*	Yukon Wild-Buckwheat		☒	G4T2Q/S2		BLM, FWS, NPS, N, S?
Erysimum asperum var. *angustatum*	Narrow-leaved Prairie Rocket		☒	G5T2/S1S2		FWS, NPS, N, S?
Gentianopsis detonsa ssp. *detonsa*	Sheared Gentian		✓			
Koeleria asiatica	Oriental Junegrass	H	✓			
Lesquerella calderi	Calder's Bladderpod		☒	G3/S1S2		FWS, FS
Ligusticum caldera	Clader's Lovage		♦	G3/S1	S	FWS, FS

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants Along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Mertensia drummondii	Drummond's Bluebell		☒	G2Q/S2	CAFF	BLM, N, SB
Montia bostockii	Bostock's Miner's-lettuce	M, TL	✓			
Oxytropis arctica var. *barnebyana*	Barneby's Locoweed	TL	☒	G4T2/S2	CAFF	BLM, DOD, N
Oxytropis huddelsonii	Huddelson's locoweed	H	✓			
Oxytropis kobukensis	Kobuk Locoweed		☒	G2/S2		NPS, N
Papaver alboroseum	Pale Poppy	M	✓			
Papaver gorodkovii	Arctic poppy		✓			
Papaver walpolei	Walpole Poppy		✓			
Parrya nauruaq	None		✓			
Pedicularis hirsuta	Hairy horsewort	C, M, TL	✓			
Phacelia mollis	Macbride Phacelia		✓			
Pleuropogon sabinei	Sabine-grass	C, M	✓			
Poa hartzii ssp. *alaskana*	Alaskan bluegrass		☒	G3G4T1/S1	CAFF	BLM, FWS, N, SB
Poa porsildii	Porsild's Bluegrass		✓			
Podistera yukonensis	Yukon Podistera		♦	G2/S1		BLM, NPS, N, S?
Polystichum aleuticum	Aleutian Shield-fern		♦	G1/S1	E, CAFF	DOD, FWS
Potentilla stipularis	Circumpolar Cinquefoil	H, TL	✓			
Primula tschuktschorum	Chukchi Primrose	H	✓			
Puccinellia wrightii	Wright's alkaligrass		✓			
Ranunculus camissonis	None	H	✓			
Ranunculus glacialis var.[a]	Glacier crowfoot	TL	✓			
Ranunculus turneri	Turner's Buttercup		✓			
Rumex graminifolius	Grassleaf sorrel	H	✓			
Rumex krausei	Cape Krause Sorrel		☒	G2/S2	CAFF	BLM, S?

TABLE 5.3-2 Potential for Occurrence of Rare and Sensitive Plants Along the Proposed Project Route

Scientific Name	Common Name	Potential Occurrence by Reference	Plant Listing	ANHP Rank	Formal Status	Listing Agency
Salix retucuata ssp. *glabellicarpa*	Smooth-fruited Netleaf Willow		♦	G5T2/S1	S	FS
Saxifraga aleutica	Aleutian Saxifrage		♦	G2G3/S2S3	CAFF	DOD, FWS, N
Senecio moresbiensis	Queen Charlotte Butterweed		♦	G3/S2	S	FS
Smelowskia johnsonii	Johnson's false candytuft	M	✓			
Smelowskia pyriformis	Pear-fruited Smelowskia	H	☒	G2/S2		BLM, FWS, SP, SB
Trisetum sibiricum ssp. *litorale*	Siberian False-oats	H	✓			

Key:
♦– On the Alaska Rare Plant List
☒– On both the BLM Sensitive Plant List and the Alaska Rare Plant List
✓ – On the BLM Sensitive Plant List.
1 – Critically imperiled (5 or fewer occurrences)
2 – Imperiled (6 to 20 occurrences)
3 – Rare or uncommon (21 to 100 occurrences)
4 – Secure, but cause for concern
5 – Secure
a – same species
b – *Erysimum angustatum* in Hulten
BLM – U.S. Bureau of Land Management
C – Carlson et al., 2006
CAFF – Designated as Rare by the Conservation of Arctic Flora and Fauna Program
DOD – U.S. Department of Defense
E – Listed as Endangered by FWS
FS – Forest Service
FWS – U.S. Fish and Wildlife Service
G# – Heritage rank globally
H – Hulten 1968
M – Murray 1987
N – Native (regional or village corporation)
NPS – National Park Service
Q – Taxonomically questionable
S – Designated as Sensitive in Alaska by FSW
S# – Heritage rank in Alaska
S? – Unknown
SB – State or Borough land
SP – State Park
T# – Heritage rank of subspecies/variety
TL – Toolik Lake, Carroll et al., 2003

5.3.2 Environmental Consequences

5.3.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed and there would therefore be no impacts to terrestrial vegetation communities.

5.3.2.2 Proposed Action

This section describes the potential impacts to vegetation communities from proposed Project construction and operation activities. It includes the ROW, aboveground facilities, and extra work areas outside the ROW (e.g., Temporary Extra Workspaces [TEWS]). The alternatives and options considered and the types of activities that would be expected to occur during each phase of the proposed Project are discussed. Some land cover types summarized are not vegetation specific (e.g., open water or barren), but are still reported to provide a complete description of the ROW composition and to facilitate absolute percent composition calculations rather than relative percent composition (Table 5.3-3).

Pipeline Right-of-Way

Construction ROW

The proposed Project would cross 16 land cover types (excluding wetlands – described in Section 5.4, Wetlands) within the 100-foot wide construction ROW. Construction activities will require additional lands (TEWS) in specific geographic areas (slopes). The TEWS acreage calculations, in addition to construction acreage for vegetation communities, are included in Table 5.3-3. For the permanent ROW, the proposed Project would retain a variable corridor of 30, 51 and 52 foot-widths along the 737-mile pipeline corridor.

The following sections discuss activities that are proposed to occur during the construction of the 100-foot wide ROW and during operations and maintenance of the permanent variable width ROW, with associated potential impacts.

Clearing, Grubbing, and Grading

Clearing, grubbing, and grading of vegetation in the proposed ROW would occur during pre-construction activities. Grading may include separating the topsoil (including the vegetative layer and roots) from the subsoil mineral layer to create a flat working surface for construction. Top soils would be segregated and stored for rehabilitation use. Pre-construction activities would begin in the summer prior to the first season of pipeline construction. It is expected that construction would occur for up to 4 months in duration from surveying to rehabilitation (Section 2.2.2). Subsoil exposed to physical environmental properties before construction could cause erosion, and sedimentation impacts and the extent of impacts would depend on the length of time the soil is exposed. An agency approved Storm Water Pollution Prevention Plan (SWPPP) and Erosion Sediment Control Plan (ESCP) would minimize or mitigate such impacts.

Grading and topsoil stripping would likely destroy the plant rootstock, which would delay vegetation recovery substantially. Areas that are constructed in the winter on ice pads would have considerably less impact since grading would occur only over the centerline. Natural establishment of native vegetation should occur over time from slow encroachment and seed dispersal of surrounding vegetation. However, sensitive plants or species that are intolerant to this type of disturbance may not fully recover.

Herbaceous and scrub-shrub vegetative communities would be expected to recover within 5 to 20 years (ADFG 2001). Forested vegetation would take much longer to recover due to the length of time it takes for trees to reach maturity. Where forested vegetation is allowed to grow back (in areas outside of the permanent ROW), it would take several decades to several hundred years to reach pre-disturbance conditions (ADFG 2001). The potential for disturbance to forested vegetation types is reduced by associating the proposed Project alongside existing infrastructure where the amount of forested vegetation is generally less.

TABLE 5.3-3 Vegetation Communities (Acres) within the proposed Construction and Permanent ROW including the Fairbanks Lateral and Denali National Park Route Variation

	MP 0 to MP540			Fairbanks Lateral		MP 540 to MP 555			Denali National Park Route Variation		MP 555 to END		
Description1	**Construction ROW (Acres)**	**TEWS (Acres)**	**Permanent ROW (Acres)**	**Construction ROW (Acres)**	**Permanent ROW (Acres)**	**Construction ROW (Acres)**	**TEWS (Acres)**	**Permanent ROW (Acres)**	**Construction ROW (Acres)**	**Permanent ROW (Acres)**	**Construction ROW (Acres)**	**TEWS (Acres)**	**Permanent ROW (Acres)**
Open Water	43.1	2.8	8.1	0.8	0.2	2.8	0.5	0.4	1.6	0.3	7.5	1.2	2.2
Developed, Open Space	15.5	2.4	3.1	6.0	1.8	0.0	0.0	0.0	0.4	0.1	66.5	5.4	17.4
Developed, Low Intensity	1,289.9	34.6	499.1	7.0	2.2	0.1	0.0	0.0	85.1	29.1	329.7	15.5	94.5
Developed, Medium Intensity	10.7	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	1.1	2.3
Developed, High Intensity	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barren Land	307.3	36.0	129.1	0.7	0.1	1.3	0.0	0.2	12.2	4.1	10.3	1.2	3.4
Deciduous Forest	458.3	45.0	147.5	34.5	10.5	6.8	0.2	1.0	0.0	0.0	543.5	77.9	169.7
Evergreen Forest	1,621.6	209.3	646.7	110.9	33.4	278.6	20.2	35.6	67.5	21.1	213.0	33.5	64.3
Mixed Forest	196.5	25.5	62.3	7.8	2.4	20.1	1.8	2.4	3.2	1.0	536.5	58.7	163.6
Dwarf Scrub	755.7	79.2	291.4	0.0	0.0	0.2	0.0	0.0	1.5	0.4	3.4	0.0	0.9
Scrub/Shrub	1,026.4	128.0	443.3	7.7	2.2	109.7	6.4	13.9	11.9	3.7	242.2	22.5	73.8
Grassland/Herbaceous	13.9	0.4	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sedge Herbaceous	743.2	74.6	236.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0
Pasture/Hay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.4
Cultivated Crops	2.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	2.8
Total	**6,484.80**	**637.80**	**2,474.40**	**175.40**	**52.80**	**419.60**	**29.10**	**53.50**	**183.40**	**59.80**	**1,970.00**	**217.30**	**595.30**

[a] Acreages derived from NLCD GIS data. Due to the methods used to determine land cover/vegetation for large-scale data sets (such as the NLCD), actual field conditions may differ from those reported. Areas within maintained ROWs specified as containing mixed forest vegetation may contain open vegetation that is not represented in the values reported in the NLCD data and this table.

[b] Acreage calculations are based on 100-foot wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012)

[c] Mainline pipeline operational footprint calculations are based on a 52-foot-wide ROW on federal lands and an approximately 30-footwide ROW on private lands. Fairbanks Lateral operational footprint calculations are based on a 51-foot-wide ROW on federal lands and an approximately 30-foot-wide ROW on private lands.

[d] Estimate is based on NLCD data and does not capture all open water areas, as are discussed in the delineated wetland data in Section 5.4, Wetlands.

[e] The total may not equal the sum of each individual due to rounding

Non-native and Invasive Plants

Non-native plants found in Alaska can be associated with natural processes (fluvial, animal, and fire) but are primarily correlated with anthropogenically disturbed areas (roads, trails, recreation sites, and gravel pits). ANHP (2011b) documented that 70 percent of recorded infestations of non-native plants were due to fill importation projects, 2.4 percent and 1.7 percent for mowing and material extraction respectively. Most infestations found in Alaska are relatively small ($\leq$0.01 acres) because they are associated with anthropogenic activities which can be eradicated (ANHP 2011b). Project construction could propagate non-native and invasive plants through several pathways. However, propagation would likely be limited to the area of disturbance, which would be mitigated. These potential pathways include:

- Transport and use of construction equipment and personnel from the continental United States where invasive and non-native plants are common;
- Spread of invasive and non-native plants already associated with existing ROWs (ARRC, TAPS, and Highways) by construction equipment and personnel;
- Transport of invasive plant material from other areas within the state via: machinery, footwear and clothing, hand tools, and vehicle tires; and
- Seed mixtures used to revegetate exposed soils could contain invasive and non-native seeds. However, mixtures have a maximum allowable weed seed limit.

Invasive plants thrive and establish quickly on recently disturbed soils (Section 5.3.1.3). The non-native plant species with the highest ranking for invasiveness in Alaska are: the spotted knapweed (*Centaurea stoebe)*, purple loosestrife (Lythrum salicaria), white sweetclover (*Melilotus alba),* meadow hawkweed (*Hieracium caespitosum),* cheatgrass (*Bromus tectorum),* Canada thistle *(Cirsium arvense),* European bird cherry (*Prunus padu*), bird vetch (*Vicia cracca),* and Siberian pea shrub *(Caragana arborescens*) (ANHP 2012a). White sweetclover has the most extensive distribution of the list of species noted above due to its adaptable properties and introduction into Alaska in the early 1900's (AKDNR 2011). The ANHP has reported white sweetclover in the Arctic, interior and coastal areas of Alaska where it thrives along roadside and disturbed areas. White sweetclover is currently found along the area of the proposed Project (Livengood, Fairbanks, Wiseman, and Healy) (ANHP 2012a). White sweetclover degrades natural grasslands, is fire tolerant, alters soil characteristics, is highly prolific and the seeds have been proven to be viable for 81 years (ANHP 2011a). Bird vetch is another highly invasive species that has been documented in areas proposed for Project development. Invasive plants are aggressive in growth and reproduction, are generalists, and are tolerant to many environmental conditions. Thus, they outcompete and displace native plants once exposure allows establishment. This causes a reduction in biological diversity and community composition. Changes in the composition of vegetation can in turn affect wildlife that inhabits these areas (Section 5.5, Wildlife).

Invasive and non-native plants are documented along much of the Dalton Highway and the George Parks Highway (ANHP 2011a). In areas along the proposed ROW that are associated with existing ROWs (ARRC, TAPS, Highways), this could create further invasion of non-native plants. The majority of the proposed Project would parallel these transportation corridors, and the spread of invasive plants could occur throughout the proposed Project's construction workspace. A robust Non-native Invasive Plant (NIP) Prevention Plan would be required to prevent further spread of invasive plants in construction areas. Collaboration between the AGDC and the Department of Agriculture (DOA) would occur to develop an appropriate NIP Prevention Plan. Additional contributors may include the Alaska Invasive Species Working Group (AISWG), Alaska Committee for Noxious and Invasive Plant Management (CNIPM).

Trenching

Trenching involves creating a narrow ditch to place the pipeline after the area has been graded and stripped of the topsoil. Trenching would include excavating subsoil and placing it on the non working side of the trench. Preserving the topsoil and subsoil strata during excavation would be essential for rehabilitation success. This would include filling the trench with subsoil (likely clays and gravels) first and replacing the organic layer (topsoil) on top. Vegetation would reestablish on topsoil faster than in clays or gravels that may be found deeper in the ground. Blasting may occur in areas with overlying bedrock, which would result in temporary and localized disturbance of vegetation in these areas. In areas such as the Beaufort Coastal Plain, recovery of vegetation would be expected to be slower than in other areas, due to the short growing season.

Fragmentation

Fragmentation is the disruption of continuity (Lord and Norton 1990), and habitat fragmentation is the splitting of larger habitat blocks into smaller, less continuous habitat, primarily by human disturbances, such as land clearing and conversion of one vegetation type to another (Franklin et al. 2002). Linear construction projects, such as the proposed Project, can divide continuous vegetation communities and increase edge habitat (Watson 2005). Increases in edge habitat can facilitate invasive plant establishment and proliferation, which can substantially alter environmental conditions such as soil temperature and light availability (e.g., Brothers and Spingarn 1992). Habitat fragmentation and its impacts to wildlife are discussed in detail in Section 5.5, Wildlife.

The pipeline would be buried at the appropriate depth for United States Department of Transportation (USDOT) standards for the majority of its length, and the landscape would be contoured to a pre-construction form. Effects from fragmentation could take decades to recover outside the permanent ROW as noted above. Impacts would be dependent on the ability and length of time for preexisting vegetation to reestablish. Fragmentation effects would be most likely to occur in forested and shrubland areas, because the ROW would be maintained to a non-forested state. Clearing the ROW for construction through forested areas would reduce the habitat structure compared to herbaceous cover. If NIP species establish in the ROW, fragmentation may be permanent. Rehabilitation of forested vegetation in the construction ROW and temporary workspaces outside of the permanent ROW would be very slow (hundreds of years) to recover to reach a mature forested state. Forest vegetation loss may be permanent, or the species composition may change. Most of the proposed Project would be adjacent to TAPS and existing ROWs thus substantially reducing the potential for additional vegetation fragmentation. Fragmentation effects could occur in areas developed where the ROW would not be collocated with existing ROWs (south of Willow, Minto Flats, and Tanana Valley State Forest).

Backfilling

Backfilling includes cleaning the trench of debris before pipeline placement, and then adding fill with excavated material after pipeline installation. Fine-grained material may be used as fill to surround the pipe. However, the placement of original excavated material near the surface would be necessary for success of vegetation establishment. Heavy vehicle activities can cause compaction of soils, which can inhibit seed germination and root establishment, and reduce water infiltration, which could result in bare soil exposure. Installation of erosion control barriers and timber mats would be required when vehicles are accessing the ROW to mitigate such impacts. Maintaining the natural soil strata would be an important aspect when backfilling the trench. Subsoil would be placed in the trench first and covered with topsoil to maintain the natural strata, and improve rehabilitation success of the vegetation community.

Dust Deposition

Dust deposition would contribute temporary impacts to the construction ROW, primarily from hauling backfill and lining material to the construction area, and from crew vehicles accessing the construction site daily. Heavy vehicle use on existing gravel roads would introduce more dust into the air than regular passenger vehicles. Additionally, numerous trips would be made between the material site and the construction area. Dust deposition would be greater during the summer months due to the dryer conditions and exposure of gravel on the road versus snow and ice. Dust would be produced at material sites from the mining of gravel and sand, which would potentially land on surrounding vegetation. However, these impacts would be localized and temporary because of the construction sequence of the proposed Project. The ROW would be constructed and rehabilitated in sequence along the pipeline in segments. Impacts from the construction of the ROW would be expected to be temporary and localized to the construction activity for that segment of the proposed Project.

Dust deposition could extend beyond the construction ROW and could interfere with plant photosynthesis and respiration. The magnitude and duration of dust deposition dictates the intensity of potential impacts (Auerbach et al. 1997), and in extreme cases, leads to the loss of more sensitive species, altering the composition of the plant community.

Rehabilitation

Rehabilitation of the area includes cleanup of remnant debris and finish grading to pre-construction contours as much as possible. Soil compaction and erosion control would be maintained by the use of low-ground pressure vehicles, and permanent erosion control measures would be installed as required. Rehabilitation would occur during the rain free period to prevent rutting from vehicles, since rutting would cause pooling of water, prevention of seed germination, and later, additional erosion. The methods used to revegetate the ROW would be determined by site-specific conditions since not all revegetation or rehabilitation techniques would be successful for all vegetation communities and ecoregions. The speed of vegetation recovery during post-rehabilitation would be influenced primarily by the ecoregion, surrounding vegetation community, construction season, and the efficacy of restoration efforts.

An Erosion and Sediment Control Plan, SWPPP, and a Stabilization, Rehabilitation, and Restoration Plan would be developed and approved prior to proposed Project implementation. These plans would identify appropriate restoration and re-vegetation measures, including de-compaction and seeding rates. Revegetation measures would be implemented to promote the establishment of vegetation within the proposed Project area throughout the life of the proposed Project. Plant seed required for rehabilitation will require testing, to ensure that the seeds (native and non-native) are adapted and/or Alaska developed for success of the revegetation efforts. The Stabilization, Rehabilitation and Restoration Plan would include regular long term monitoring of the ROW during the post-rehabilitation phase. The monitoring plan would identify problem areas where revegetation has not occurred and provide for additional mitigation as necessary. Specific documents that could be used to develop proposed Project and site-specific rehabilitation plans include:

- The Alaska Coastal Revegetation and Erosion Control Guide (Wright and Czalpa 2010);
- Interior Alaska Revegetation & Erosion Control Guide;
- Strategic Plan for Invasive Weed and Agricultural Pest Management and Prevention In Alaska;
- Native plant revegetation manual for Denali National Park and Preserve (Densmore et al. 2000);
- A revegetation manual for Alaska (Wright 2008); and
- NPS Invasive Plant Management Plan.

Non-native and Invasive Plants

Non-native plant seeds may be introduced and spread into the ROW area throughout the construction process by the pathways noted above. Rehabilitation of the area would include contouring the area as near to original state as possible. Post-rehabilitation of the TAPS ROW has resulted in non-native plant species establishment in the revegetated area along most of the ROW, with some invasion of native species at varying degrees (McKendrick 2002). The proposed Project would likely cause additional spread of non-native plants along the disturbed areas of the ROW due to the collocation with TAPS. Seed mixtures approved by the DOA and other agencies would be required for reestablishment of the vegetation growth in disturbed areas. This may include the use of annual ryegrass or another non-native species that may be required for temporary slope stabilization, erosion control, or as a cover crop. Implementation of an agency approved, site-specific NIP Prevention Plan would be required to mitigate for the long-term establishment and proliferation of invasive plants (see Section 5.3.3).

Soil Compaction and Erosion

Construction of the ROW may compact soils along the construction area from heavy equipment use which could inhibit seed germination, reduce water infiltration, inhibit root establishment, and result in bare soil exposure. Construction activities during the rainy periods could cause rutting where water would pool and delay seed germination and growth. Rehabilitation of the area during post construction would contour the ROW to pre-construction contours for optimal vegetation establishment and seed germination.

Permanent ROW

The permanent ROW would retain a variable width of 30, 51, and 52 feet along the 737-mile pipeline corridor. The width of the permanent ROW would be maintained, dependant on land ownership of that segment of the ROW. Approximately 4,149 acres of land would be permanent easement or grant ROW. The vegetation within the permanent easement or grant would be maintained to a non-forested vegetation cover (Section 2.1.3). The aboveground facilities and extra work areas outside the ROW include acreage of vegetation impacted from operations.

Mowing

Mowing or clearing the vegetation overstory of the ROW would occur as needed on a regular basis to allow for visual inspections of the pipeline from aerial patrols. Approximately 1,340 acres of forested and 1,066 acres of scrub/shrub land exists within the permanent ROW and would be affected by vegetation clearing (Section 5.9.1.3). Vegetation communities impacted by segments of the construction and permanent ROW are included in Table 5.3-3.

Regular maintenance of the permanent ROW would include mowing surface vegetation to a non-forested vegetative cover type. Forested land within the permanent ROW (1,340 acres) would be permanently removed and would be maintained, potentially as a scrub/shrub vegetative type. Forest vegetation outside of the permanent ROW, but inside the construction area, would be allowed to grow back and would reestablish to mature forest vegetation through succession over the long term.

Impacts from mowing non-forested vegetation would not constitute a substantial additional negative impact to that vegetation type, since vegetation would potentially grow denser as it is trimmed to maintain a low ground cover. Maintenance of the ROW would occur during dryer months when rutting and erosion from equipment would be less likely to occur. Mowing in the pre-nesting season would prevent additional impacts to wildlife such as nesting migratory birds (Section 5.5, Wildlife). The spread of invasive plant species could occur from transporting and traversing mowing equipment from one location to another along the ROW. However, a long-term mitigation plan (NIP Prevention Plan) would address this aspect of the maintenance program to reduce potential spread of invasive plants from mowing equipment.

Project Segments

Vegetation communities affected by segment of ROW within the construction, permanent and TEWS workspace are identified in Table 5.3-3. The following information includes a short discussion on the vegetation composition in each segment of the ROW, including the Denali National Park Route Variation and Fairbanks Lateral.

MP 0 to MP 540

The proposed Project would closely follow the TAPS ROW along the Dalton Highway, from Prudhoe Bay to the community of Livengood (Figure 5.3-1, Maps 1-3). Much of this area was heavily disturbed during TAPS construction and now differs markedly from adjacent natural vegetation (McKendrick 2002). The surrounding areas are predominantly wetland communities of sedges, low shrubs, or shallow water marshes (*Arctophila fulva*), while within the TAPS ROW, vegetation is primarily comprised of species planted for revegetation purposes, such as red fescue (*Festuca rubra*), or species that frequently colonize gravels of nearby river channels, such as dwarf fireweed (*Epilobium latifolium*).

The key land use types in the construction ROW include approximately 20 percent developed, 35 percent forested, 16 percent scrub/shrub, 12 percent dwarf scrub, and 11 percent sedge/herbaceous land (Table 5.3-3). The remaining 6 percent land use types include barren land, open water, grassland/herbaceous, pasture, and cultivated crops (Table 5.3-3). The predominant forest type is evergreen, which would reestablish outside the permanent ROW over a long period of time (decades to more than a century). The TEWS vegetation acreage affected includes 44 percent forested, 20 percent scrub/shrub, 12 percent dwarf scrub, 12 percent sedge herbaceous, and 6 percent developed, with the remaining 6 percent is barren, open water and grassland. As noted earlier, of all vegetation types, forest vegetation would experience the highest impacts, due to the length of time it takes for succession of the vegetation to reach maturity. In addition, forest vegetation removal would create the highest visual impact and would also impact specific bird species (e.g., raptors) to a greater extent (see Section 5.5, Wildlife).

South of Livengood, the proposed Project would pass through Minto Flats State Game Refuge, a large complex of undisturbed wetlands and boreal forest, heavily influenced by numerous river meanders and frequent fire succession (Figure 5.3-1, Map 4). Near Dunbar, the proposed Project would begin to follow the George Parks Highway corridor where vegetation composition along much of this area consists of disturbed vegetation communities.

Much of this segment is associated with existing pipeline or highway ROWs, and developed land (low intensity) comprises approximately 20 percent of the total land cover within the ROW. Forest vegetation (evergreen, deciduous, and mixed), scrub/shrub, and sedge/herbaceous comprise approximately 35 percent, 18 percent, and 9 percent of the land cover respectively for the permanent ROW (Table 5.3-3). The remaining 18 percent includes the open water, barren land, dwarf scrub, grassland herbaceous, pasture, and cultivated crops (Table 5.3-3).

Yukon River Crossing Options

As described in Section 2.2.3.2, the proposed Project would cross the Yukon River in one of three ways: via a suspension bridge to be constructed (the Applicant's Preferred Option), via the existing highway bridge (Option 2), or via Horizontal Directional Drilling (HDD) (Option 3). The construction of the ROW for the Applicant's Preferred Option would include impacts to approximately 48 percent forested vegetation and no loss to scrub/shrub vegetation. Approximately 8 percent of the area is developed land (low intensity), and the remaining percentages include open water and wetlands. Wetlands are described in detail in Section 5.4, Wetlands. For Option 2, areas impacted by construction would be 23 percent forested vegetation, 3 percent scrub/shrub, and 54 percent is currently developed. The remaining land use types for Option 2 are included as open water (5 percent) and wetlands (16 percent).

For Option 2, forested vegetation impacts for the permanent ROW would be approximately 24 percent, versus 44 percent for the Applicant's Preferred Option. For the permanent ROW, 50 percent of the land cover for Option 2 is developed land (low intensity), versus 6 percent for the Applicant's Preferred Option. Eighteen percent is open water for the Applicant's Preferred Option, versus 2 percent for Option 2. Thirty-two percent is wetlands for the Applicant's Preferred Option versus 20 percent for Options 2. Scrub/shrub land cover types would not be impacted in the Applicant's Preferred Option; however, 4 percent would be impacted in Option 2.

Option 3 would result in construction of one acre of land within the ROW on each side of the Yukon River, resulting in the same amount and types of vegetation impacted as described in the Preferred Option above.

Overall, more forested vegetation would be impacted from the building of a suspension bridge (the Applicant's Preferred Option) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Bridge (Option 2).

Fairbanks Lateral

The Fairbanks Lateral extends approximately 34 miles from near Dunbar, headed northeast to Fairbanks. This route largely follows the existing railroad corridor (Figure 5.3-3, Map 4). For the construction ROW, the Fairbanks Lateral line is composed of approximately 87 percent forest vegetation, with 4 percent scrub/shrub (Table 5.3-3), 7 percent developed land, with the remaining 2 percent open water and barren land. For the permanent ROW, 88 percent of this segment is composed of forested lands (23 percent deciduous, 72 percent evergreen, and 5 percent mixed forest). Seven percent is developed, 4 percent scrub/shrub, and <1 percent open water and barren land (Table 5.3-3). This area also contains wetlands (see Section 5.4, Wetlands).

MP 540 to MP 555

This segment of the proposed Project would extend east of the George Parks Highway corridor, avoiding Denali National Park. The proposed mainline route (MP 540 to MP 555) would pass through undeveloped land, impacting approximately 73 percent forest and 20 percent scrub/shrub vegetation types. The remaining 7 percent would be open water, barren land, developed, and dwarf scrub for the construction ROW. The TEWS acreage for vegetation impacts includes 76 percent forested land, 22 percent scrub/shrub, and 2 percent open water. For the permanent ROW, forested vegetation composes approximately 73 percent of the vegetation community, with scrub/shrub composing 26 percent, and the remaining one percent barren and open water (Table 5.3-3). The majority of forest vegetation is evergreen along this route. No developed land currently exists in the proposed permanent ROW. An alternative to the proposed route is discussed below.

MP 555 to END

This segment extends south from the Denali National Park, at MP 555, to the pipeline terminus near the Knik Arm in the Cook Inlet (Figure 5.3-1, Map 6). The majority of the route follows the George Parks Highway, but the section that continues south of Willow does not, and instead traverses to the west through undeveloped areas leading to the proposed NGLEP location. The construction ROW for this segment is composed of approximately 17 percent developed land (82 percent of which is low intensity), 66 percent forest (mainly deciduous), and 11 percent scrub/shrub vegetation (Table 5.3-3). Six percent includes the composition of barren land, open water, dwarf scrub, sedge herbaceous, and cultivated crops for the construction and permanent ROW (Table 5.3-3). The vegetation communities affected by TEWS include 10 percent developed land, 10 percent scrub/shrub, and 78 percent forested for this segment of the proposed Project. For the permanent ROW, approximately 19 percent of the area is considered developed land, and 67 percent and 12 percent is composed of forest and scrub/shrub vegetation respectively (Table 5.3-3). The remaining 2 percent is composed of open water, barren land, pasture, and cultivated crops (Table 5.3-3).

Aboveground Facilities

Aboveground facilities would require approximately 80 acres of land during construction and operations (Section 2.1.2). Development of aboveground facilities would result in permanent loss of vegetation from gravel fill placement to develop pads. Table 5.3-4 includes the acreage of vegetation types impacted by aboveground facility development. This table is discussed in detail in Section 5.3.2.1.

Five types of aboveground facilities would be built for operations of the proposed Project. These are: gas conditioning facility (GCF), mainline valves (MLVs), compressor station (CS), straddle off-take facility, and natural gas liquid extraction plant (NGLEP) facility (Section 2.1.2). The vegetation communities that would be impacted by construction and operation of these major aboveground facilities for the proposed Project are described in Table 5.3-4.

The development of the GCF would affect the most vegetation, including approximately 68.5 acres of sedge/herbaceous vegetation. The MLVs would require an area of approximately 0.5 acres or less, which would not cause substantial impacts to any particular vegetation type. The CS at MP 225 would potentially affect approximately 1.4 acres of scrub/shrub vegetation. The CS at MP 286.6 would affect 1.3 acres of forested vegetation. The CS at MP 458.1 would impact 3.3 acres of forested vegetation, the majority of which would be located in a deciduous forest type. The NGLEP facility would be constructed in 4.7 acres of forested vegetation (Table 5.3-4). Overall, substantial vegetation impacts from permanent loss of forest vegetation would occur from the development of aboveground facilities for the proposed Project.

Extra Work Areas Outside of ROW

Access roads are extra work areas that would affect vegetation resources. Access roads would be used by facility personnel to operate and maintain the pipeline and associated facilities.

Access Roads

The proposed mainline route would require the use of 107 permanent gravel roads, 60 of which would be new roads developed for the Project. Roads would be used to transport material, equipment and personnel, and to access water sources, material sites and camps. Section 5.9, Land Use, contains further details on access roads. Approximately 552 acres of access roads would be used by the proposed Project for the permanent ROW. The majority of these roads (73 percent) would be located between MP 0 to 540 (Section 5.9.1.4). Five additional roads would be used for the Fairbanks Lateral.

There are four main impacts expected for increased road use and development. Permanent vegetation loss, dust deposition, non-native and invasive plant dispersal, and fragmentation. Vegetation would be permanently lost from road development, but the vegetation surrounding the constructed road would also be impacted by dust deposition, invasive plant dispersal, and fragmentation. Forested vegetation would receive most impacts of the vegetation communities from access road development (Section 5.3.1.4). Forested vegetation would be permanently removed for road development and clearing of the associated ROW for maintenance purposes. Collaboration between the AGDC and the appropriate agencies (ADNR and BLM) would occur to develop an appropriate NIP Prevention Plan.

Permanent impacts from road development along the Fairbanks Lateral would be to 76 percent forest, 4 percent scrub/shrub vegetation, and 23 percent developed areas. Approximately 20 percent of the Fairbanks Lateral is developed. Acreage for vegetation communities found along proposed and existing access roads is included in Table 5.3-5. Impacts from access roads developed for the mainline route would be 72 percent forest and 19 percent scrub/shrub vegetation. Approximately 5 percent of the mainline access road route is classified as developed. The remaining composition of vegetation communities includes 1 percent dwarf sedge; 1 percent sedge herbaceous; and 1 percent for barren land, grassland/herbaceous, crops, and open water combined. The acreage for vegetation communities is included in Table 5.3-5.

TABLE 5.3-4 Vegetation Communities (Excluding Developed Lands) Impacted by Construction and Operation of Aboveground Facilities

Description	GCF (MP 0.0)	MLVs (Construction/ Operation) (various locations)[a, b]	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Compressor Station (MP 458.1)	Straddle and Off-Take Facility (MP 458.1)	NGLEP Facility (MP 736.4)
Open Water[c]	0.3	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0
Developed, Low Intensity	0.0	0.1/0.5	0.0	0.0	0.0	0.0	0.3
Barren Land	0.0	0.0/0.1	0.0	0.0	0.0	0.0	0.0
Deciduous Forest	0.0	0.1/0.3	0.0	0.0	<0.1	2.6	0.0
Evergreen Forest	0.0	0.2/0.5	0.0	1.3	1.4	0.8	3.0
Mixed Forest	0.0	0.1/0.2	0.0	0.0	0.0	0.0	1.7
Dwarf Scrub	0.0	0.0/0.1	0.0	0.0	0.0	0.0	0.0
Scrub/Shrub	0.0	0.2/0.4	1.4	0.2	0.0	0.0	0.0
Sedge/Herbaceous	68.5	0.1/0.3	0.0	0.0	0.0	0.0	0.1
Total[d]	**68.7**	**0.8/2.4**	**1.4**	**1.4**	**1.4**	**3.3**	**5.2**

[a] MLV acreages account for those portions of the valves that extend outside of the permanent or construction ROWs.

[b] Note that the AGDC indicated that two MLVs would be required along the Fairbanks Lateral, but has not identified their locations. It is assumed that these facilities would encumber approximately 0.1 acre of land. Because the location of these facilities is not known, their overlap with the proposed construction and operational ROWs could not be determined. Therefore, acreages associated with the two MLVs are not included in the above table.

[c] Estimate is based on NLCD data and does not capture all open water areas, as discussed in the delineated wetland data in Section 5.4, Wetlands.

[d] The sum of the individual entries may not match the overall total due to rounding.

TABLE 5.3-5 Vegetation Communities Found Along Proposed and Existing Access Roads[a]

Description	Fairbanks Access Roads (Acres)		Mainline Access Roads (Acres)	
	Construction[b]	Operational[c]	Construction[b]	Operational[c]
Open Water	0.2	0.2	0.1	0.1
Developed, Open Space	0.1	0.1	1.2	0.2
Developed, Low Intensity	14.1	14.1	28.4	26.2
Developed, Medium Intensity	0.0	0.0	1.3	1.3
Barren Land	0.1	0.1	1.9	1.8
Deciduous Forest	13.3	13.3	138.5	130.8
Evergreen Forest	31.7	31.7	181.2	180.4
Mixed Forest	8.1	8.1	62.9	60.4
Dwarf Scrub	0.0	0.0	6.0	5.1
Scrub/Shrub	2.5	2.5	104.8	101.1
Grassland/Herbaceous	0.0	0.0	4.6	4.6
Sedge/Herbaceous	0.0	0.0	5.3	4.9
Cultivated Crops	0.0	0.0	2.3	2.3
Total	**70.1**	**70.1**	**538.5**	**552.3**

[a] Source: 2001 National Landcover Data Set. Acreage estimates include roadway coverage provided by AGDC and not complete 50 foot ROW.

[b] Construction acreage includes permanent and temporary new and existing access roads.

[c] Permanent operational acreage includes permanent access roads.

Note: Some operational and construction impact acres for the Fairbanks Lateral access roads are the same because all Fairbanks access roads are permanent (no temporary roads).

Dust Deposition

Dust would be generated from development of 60 permanent gravel roads and the use of 30 existing gravel roads. Gravel would be placed as fill to construct access roads, and the transportation of gravel with heavy trucks from material sites to road construction areas would create dust deposition onto the surrounding area. Heavy machinery, including dump trucks, would produce more dust than regular passenger vehicles.

Dust deposition in the construction ROW would result in temporary, local impacts to vegetation communities. Impacts would occur by pipeline segment and season, as the proposed Project is constructed. Impacts would depend on dust particle size, wind processes, wetting of the ground, duration and frequency of traffic, and speed of travel. Dust deposition could extend beyond the construction ROW and could interfere with plant photosynthesis and respiration. The magnitude and duration of dust deposition dictates the intensity of potential impacts (Auerbach at al. 1997), and in extreme cases, leads to the loss of more sensitive species, altering the composition of the plant community. The AGDC would implement BMPs during construction to reduce fugitive dust (Section 5.15, Air Quality).

Regular vehicle use during construction and operation of the proposed Project would also create dust along roadsides and pads. An enforceable road maintenance plan and on-site driving rules would aid in reducing dust deposition surrounding roads and facilities. During operations, long-term dust deposition can potentially cause thermokarst effects in permafrost areas along access roads. Melting snow along roadsides is accelerated as dust is deposited over time. These areas cause a depression in the vegetation from melting permafrost which can alter vegetation growth and species composition. Early snowmelt along roadsides exposes vegetation earlier than surrounding non-dusted vegetation, which can attract wildlife near the road, potentially causing increased mortality from vehicle collisions (Section 5.5, Wildlife). Additional information regarding dust generation and applicable minimization measures are discussed further in Section 5.15, Air Quality.

Non-native and Invasive Plants

Access road development can act as a dispersal mechanism, where untouched land becomes exposed to invasive plant species. Spread can occur from vehicles, equipment, hand tools, boots, and clothing. Invasive plants establish quickly on exposed soils, and impacts could be long term from continued exposure of NIP species along roadways. An agency approved NIP Prevention Plan that includes regular monitoring and assessment would be required to prevent invasion of non-native plant species along access roads. This plan would require updates over the long term throughout proposed Project operations to maintain the integrity of the native flora.

Rare and Sensitive Plants

Twenty-three rare and sensitive plants have been identified as potentially occurring within the proposed Project area (Table 5.3-2). Two notable areas where the probability of occurrence of rare plants could be greater would be in the Minto Flats State Game Refuge and the mainline route (MP 540 to MP 555) that bypasses Denali NPP lands. Neither of these areas are associated with existing ROW systems and are therefore comparatively undisturbed. Much of Denali NPP has been inventoried for vegetation, with more than 1,500 species of vascular plants, mosses, and lichen identified. Fifty-three vascular plant taxa considered rare in Alaska by the ANHP (ranked S3 or lower) are known to occur in Denali NPP, but none were documented along the George Parks Highway within Denali NPP (Roland 2004). The relatively undeveloped mainline route (MP 540 to MP 555) east of Denali NPP, has the potential to possess flora similar to the Denali NPP.

If rare or sensitive plant species are present along the undeveloped proposed mainline route, the plants would be subject to the same impacts as other vegetation. Often, globally rare species are also locally rare (i.e., have small population sizes) and are much more susceptible to localized extinction events. A comprehensive rare and sensitive plant inventory has not been conducted in the proposed Project area. However, the majority of the proposed ROW would be associated with existing pipeline, roadway, or utility corridors, and as such, the vegetation in these existing ROWs is currently maintained. Therefore, there is a low probability that rare or sensitive plants would occur within the proposed Project ROW.

As described further in Section 5.8, Threatened and Endangered Species, the AGDC and the U.S. Army Corps of Engineers (USACE) have consulted with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) under Section 7 of the ESA to minimize proposed Project-related impacts to federally listed threatened and endangered species; none are known to be present within the proposed Project area.

Fragmentation

Construction of 60 new gravel roads would create permanent fragmentation impacts to forested vegetation and the wildlife that depends on it (see Section 5.5, Wildlife). Access road development would impact approximately 3,887 acres of forest vegetation (Section 5.9.1.6). Habitat fragmentation would impact sensitive species or species less tolerant to habitat discontinuity, especially in forested areas of the proposed Project. Habitat fragmentation applies to wildlife and the habitat that they require to survive and is discussed in detail in Section 5.5, Wildlife.

Material Sites

Existing material sites used for the TAPS Project would provide sufficient gravel and sand for the proposed Project (Section 2.1.3.3). Impacts to surrounding vegetation from material site use include dust deposition during excavation and transport of material. Dust deposition would have local and temporary impacts to vegetation surrounding material sites where heavy equipment would be used to mine gravel and sand to be transported to road and pad development points.

Temporary Extra Workspaces (TEWS)

TEWS would be located adjacent to construction areas and would include additional areas of land required for temporary uses. These may include areas for spoil storage, staging of equipment, pull string assembly, HDD activities, and railway crossing points (Section 2.1.3.3). The size and location of these areas is dependent on site-specific conditions, and has been included in the tables associated with construction acreage above.

5.3.2.3 Denali National Park Route Variation

The Denali National Park Route Variation would traverse 7 miles of Denali National Park lands, which is collocated with the Parks Highway ROW. The proximity of this proposed route to the road corridor for most of the 15 miles is reflected in the vegetation composition of the construction ROW, of which approximately 47 percent is currently developed land (Table 5.3-3). Detailed maps for the Denali National Park Route Variation are provided on the AGDC website at http://www.agdc.us/overview/map/.

This Denali National Park route variation is composed of approximately 38 percent forest and 7 percent scrub/shrub vegetation, respectively, throughout both the construction and permanent ROWs (Table 5.3-3). Forty-seven percent developed land, 7 percent barren land, and less than 1 percent composition of open water and dwarf scrub for the construction and permanent ROW (Table 5.3-3). In comparison with the mainline route, the Denali National Park Route Variation would result in fewer impacts to vegetation resources, primarily by development of approximately 35 percent less forested vegetation and 13 percent less scrub/shrub, and by utilizing 47 percent existing developed land.

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5.4 WETLANDS

This section describes the classification and composition of wetlands identified within a 2,000 foot planning corridor along the 737 mile proposed Project right-of-way (ROW). It includes the Fairbanks Lateral, aboveground facilities, and the Denali National Park Route Variation. The analysis methodology, affected environment, and environmental consequences are discussed in detail below. The AGDC has proposed mitigation measures to reduce impacts to wetland resources, which is included in Section 5.23.2.4.

Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3(b)). Section 404 of the Clean Water Act (CWA) establishes programs to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Jurisdictional wetlands regulated by the U.S. Army Corps of Engineers (USACE) under Section 404 must exhibit a positive wetland indicator from all three characteristics – vegetation, soils, and hydrology – to make a wetland jurisdictional determination; and except in limited instances identified in the *1987 Corps of Engineers Wetlands Delineation Manual* (USACE 1987), isolated wetlands are not considered jurisdictional (EPA 2008). Under the National Environmental Policy Act (NEPA), Protection of Wetlands is defined as the avoidance, to the extent possible, of the long and short term adverse impacts associated with the destruction or modification of wetlands and the avoidance of direct or indirect support of new construction in wetlands wherever there is a practicable alternative (EPA, Exec Order No. 11990).

5.4.1 Analysis Methodology

A multi-year preliminary jurisdictional determination (PJD) was conducted along the 737 mile proposed Project within the 2,000 foot planning corridor in support of USACE permitting (AES 2012). Four main components were included in the development of the PJD: review of existing data, aerial photo interpretation, field data collection, and post field mapping and analysis. This study mapped wetlands by interpreting data at two scales: (1) the 2,000 foot (1,000 feet on each side of the centerline) planning corridor; and (2) within the 300-foot wide wetlands and uplands analysis corridor. The 2,000 foot planning corridor provides a broad spatial context for the proposed Project area, while the construction right-of-way (ROW) provides a conservative estimate of the specific wetland habitat that would be directly impacted.

A wetland and upland analysis was conducted within the proposed 300 foot construction corridor (150 feet on either side of the centerline). This analysis included field verifying the desktop analysis to confirm wetlands and uplands at field target locations throughout the length of the pipeline. The remaining 1,700 feet of the planning corridor was interpreted primarily from aerial photographs and the select field target locations chosen for ground truthing (AES 2012). Areas with field-verified characteristics that met the three wetland criteria, as outlined in the

USACE *Wetland Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region* (USACE 2007), vegetation, soil, and hydrology were classified as wetlands. All wetland acreage calculations for the proposed construction and variable width permanent ROW, Temporary Extra Workspaces (TEWS), and Denali National Park Route Variation were completed by Cardno ENTRIX using spatial analysis from AES 2012 data (AGDC 2012). The access road wetland acreage calculations were conducted by creating a 50 foot buffer on either side of the proposed access road centerline. Access road wetland acreage outside of the 2,000 foot planning corridor were mapped via GIS desktop analysis by digitizing wetland upland lines using extrapolated aerial signatures from currently approved mapping (PJD mapping) (AGDC 2012). In areas of poor aerial photo coverage, best professional judgment was used to make a correlation based on the same aerial photography layers for currently mapped features.

Two classification systems were used to characterize the wetlands within the proposed Project area: The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) by Cowardin et al. (1979), Classification of Wetlands and Deepwater Habitats, and the Magee and Hollands (1998) hydrogeomorphic (HGM) classification. The NWI classification is based largely on biotic characteristics (e.g., vegetation), whereas the HGM classification describes the wetland's position in the landscape and its function using geomorphic and hydrologic characteristics. Both classification systems were used to provide information needed for a robust basis for wetland comparisons. For example, forested wetland vegetation is very slow to recover from disturbances compared to emergent wetlands which can recover much more quickly. Regardless of the type of wetland impacted, slope wetlands are more susceptible to hydrologic changes resulting from soil and vegetation changes. Using both systems as described above provides effective characterization of wetlands when considering potential impacts.

5.4.2 Affected Environment

The proposed Project corridor crosses a wide variety of wetland classes as it proceeds from the Beaufort Sea Coastal Plain southbound to the Cook Inlet Basin (Section 5.1.1.1 and Figure 5.1 -1). Wetlands are important to the ecosystem for many reasons. They support numerous species of plants and provide necessary habitat for fish, wildlife, and insects throughout various stages of their life cycles. Wetlands provide feeding, breeding, rearing, and cover habitat for numerous animals. Wetlands also act as filters while providing flood control, sedimentation, erosion control, and the stabilization of shorelines.

Wetland classes transected by the proposed Project corridor can be grouped into four major classifications using the NWI classification system, which is used as the National Wetlands Classification Standard:

- *Forested Wetlands (PFO)* – Forested wetlands include broadleaf, needleleaf, and mixed forest wetland communities. These wetlands are typically dominated by an over story of black spruce (*Picea mariana*), with an understory of alder (*Alnus* spp.), Labrador tea (*Ledum* spp.), and horsetail (*Equisetum* spp.), among others. Forested wetlands function to increase nutrient export, modify stream flow, and improve water quality;

- *Scrub/shrub Wetlands (PSS)* – Scrub/shrub wetlands include broadleaf, needle-leaf, and mixed shrub communities. These wetlands are commonly dominated by swamp birch (*Betula nana*), sweetgale (*Myrica gale*), bluejoint reedgrass (*Calamagrostis canadensis*), horsetail (*Equisetum* spp.), marsh cinquefoil (*Comarum palustre*), and sedges (*Carex* spp.). These wetlands often function similar to forested wetlands in that they increase nutrient export and improve water quality. They also support extensive bird nesting and animal browsing;
- *Emergent Wetlands (PEM)* – Emergent wetlands are dominated by graminoid species, sedges and grasses, with scattered shrubs. These can function to buffer floodwaters, moderate stream flow, facilitate nutrient export, and provide critical habitat for juvenile fish, waterfowl, and other wildlife; and
- *Other Water and Riverine Wetlands (P, R, L)* – Other water and riverine wetlands include ponds, lakes (less than 20 acres), and small streams. These open water systems can support aquatic bed vegetation like lilypads, and pondweed (*Zannichellia* spp.). Open water systems transport sediment and nutrients, provide important wildlife and fisheries habitat, as well as improve water quality, and buffer flood waters.

Wetlands crossed by the proposed Project corridor were also classified into seven HGM classes:

- *Mineral Soil Flats* – These wetlands do not receive groundwater discharge, rather they receive water from precipitation and overland flow. Flat wetlands lose water by evapotranspiration and saturation overland flow. Flat wetlands are very common in permafrost soils, but can also form from an accumulation of organic material and primarily function to store surface water and provide wildlife habitat, most notably waterfowl;
- *Depressional* – These wetlands occur in topographic depressions. Their water source is precipitation, ground water discharge, and both interflow and overland flow from adjacent wetlands. These wetlands store surface water and provide groundwater recharge and wildlife habitat;
- *Slope* – These wetlands occur where there is groundwater discharge to the surface. They are normally found along elevation gradients. They do not store surface water, or recharge groundwater. Instead, they mediate surface flow to other wetlands and waterbodies;
- *Riverine* – These wetlands occur in floodplains and riparian corridors. Their water source is primarily overbank flow, supplemented by overland flow and precipitation. Riverine wetlands can moderate stream flow, store floodwaters, and facilitate nutrient export;
- *Lacustrine Fringe* – These wetlands occur adjacent to ponds and lakes and are largely maintained by an elevated water table. They function to store floodwater and detritus (organic material) and provide habitat for wading birds and juvenile fish;

- *Extensive Peatlands* – These wetlands are created by the vertical accretion of organic matter. The water source for extensive peatlands is typically precipitation with water loss due to saturation and seepage to groundwater. Bogs or muskegs are common examples; and
- *Estuarine Fringe* – These wetlands occur along coasts and estuaries that are influenced by sea level. They intergrade with riverine wetlands where tidal current declines and river flow is the dominant source. These wetlands frequently flood from tidal exchange. Organic matter accumulates in higher elevated marsh areas. Salt marshes are an example of an Estuarine Fringe wetland. There are no wetlands of this class within the proposed Project. Therefore, they are not included or discussed further.

5.4.2.1 2,000-Foot Wide Planning Corridor

A 2,000-foot wide planning corridor (1,000 feet on either side of the centerline) was selected to provide ample coverage area for pipeline placement optimization (AES 2012), and thus represents the proposed Project area for wetland resources. The planning corridor provides a quantifiable landscape context for understanding the wetland composition by region. Without the landscape context, it would be difficult to evaluate the relative magnitude of wetlands potentially impacted within the regional landscape. The wetland compositions relative to the aboveground facilities locations are presented in Figures 5.4-1 through 5.4-5.

The 2,000 foot planning corridor is composed of 54 percent wetlands, totaling approximately 100,880 acres. The planning area includes the mapping area from milepost (MP) 0 to MP 737, and Fairbanks Lateral, with the exception of the Denali National Park Route Variation. The Denali National Park Route Variation wetland delineations were removed from the PJD since the proposed alignment of the proposed Project was located east of park property (AES 2011). Areas lacking wetland delineations from AES were supplemented with National Wetland Inventory (NWI) data. To describe these wetlands using the NWI classification, the wetlands were summarized into four classes composed primarily of palustrine scrub/shrub (59 percent), palustrine emergent wetlands (29 percent), with smaller percentages of palustrine forested and other wetlands (6 percent and 6 percent, respectively) (Figure 5.4-6). A complete list of wetland subgroups that are summarized into the four primary classes as noted above is presented in Table 5.4-1. Using the HGM classification, of these wetlands evaluated 73 percent are mineral soil flats, 12 percent are slope, 9 percent are depressional, 6 percent are riverine, and 1 percent make up the lacustrine fringe and extensive peatlands (Figure 5.4-7). These wetland acreages were calculated by Cardno ENTRIX using spatial analysis from AES 2012 data.

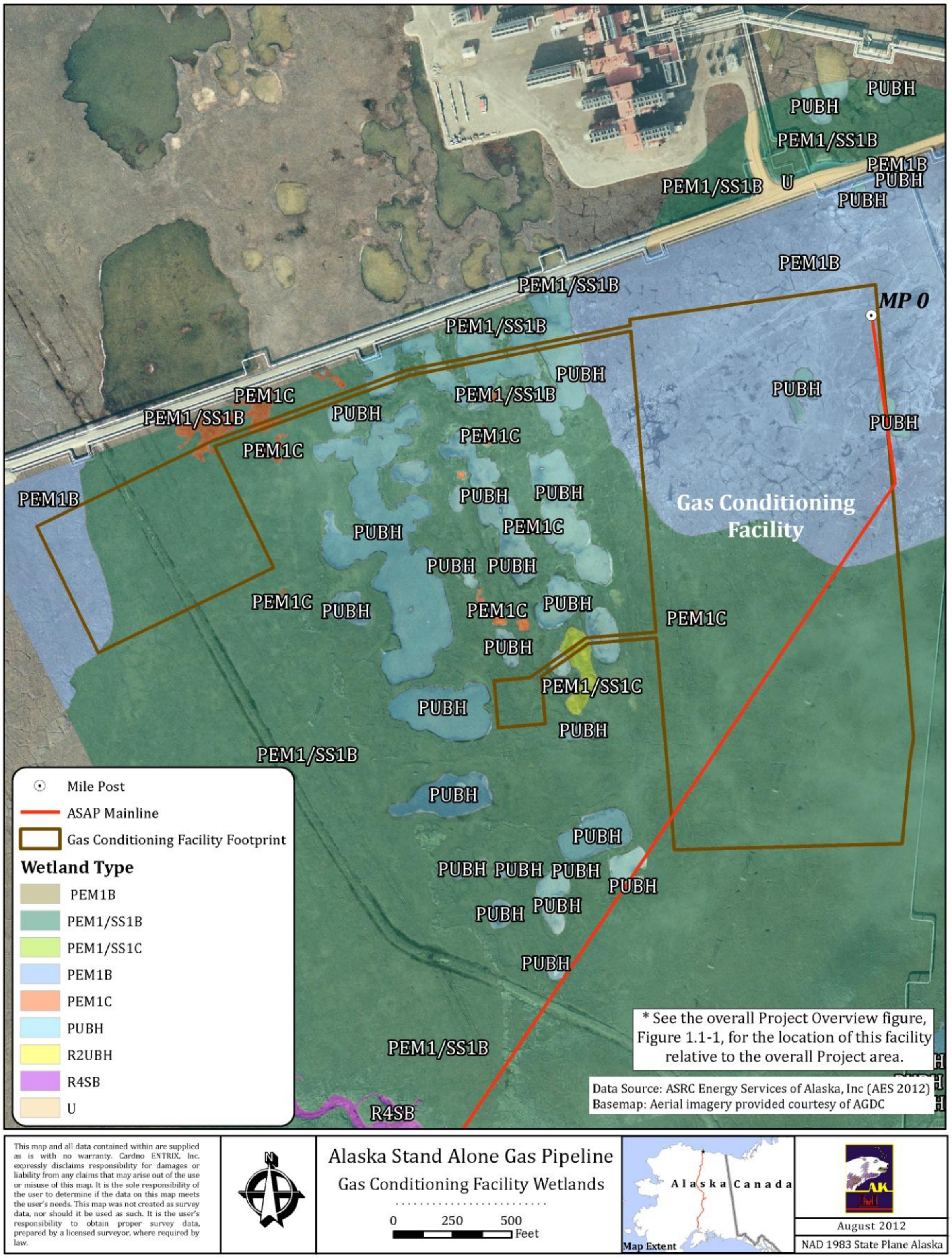

FIGURE 5.4-1 Gas Conditioning Facility Location Map with Wetlands Classified

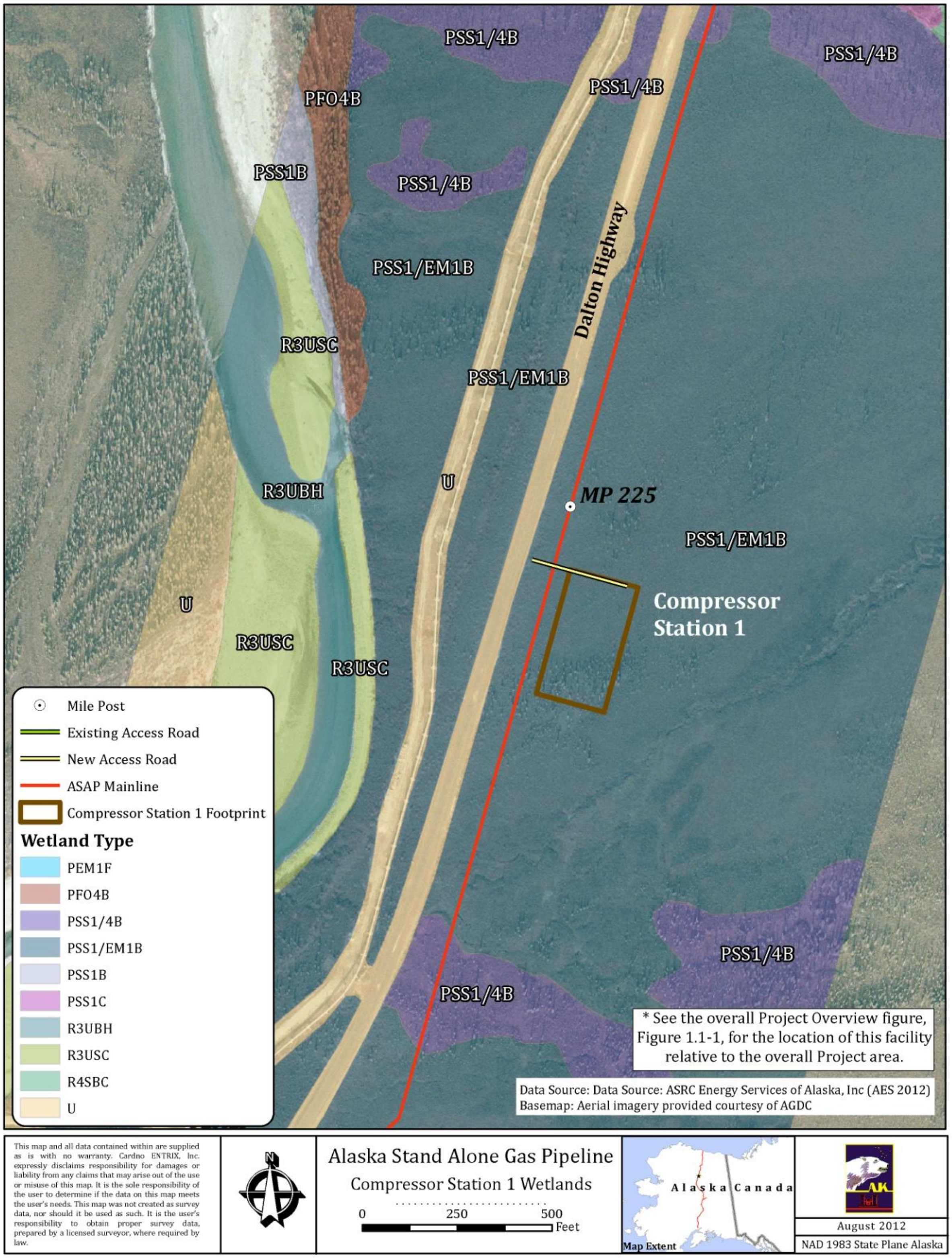

FIGURE 5.4-2 Compressor Station 1 Location Map with Wetlands Classified

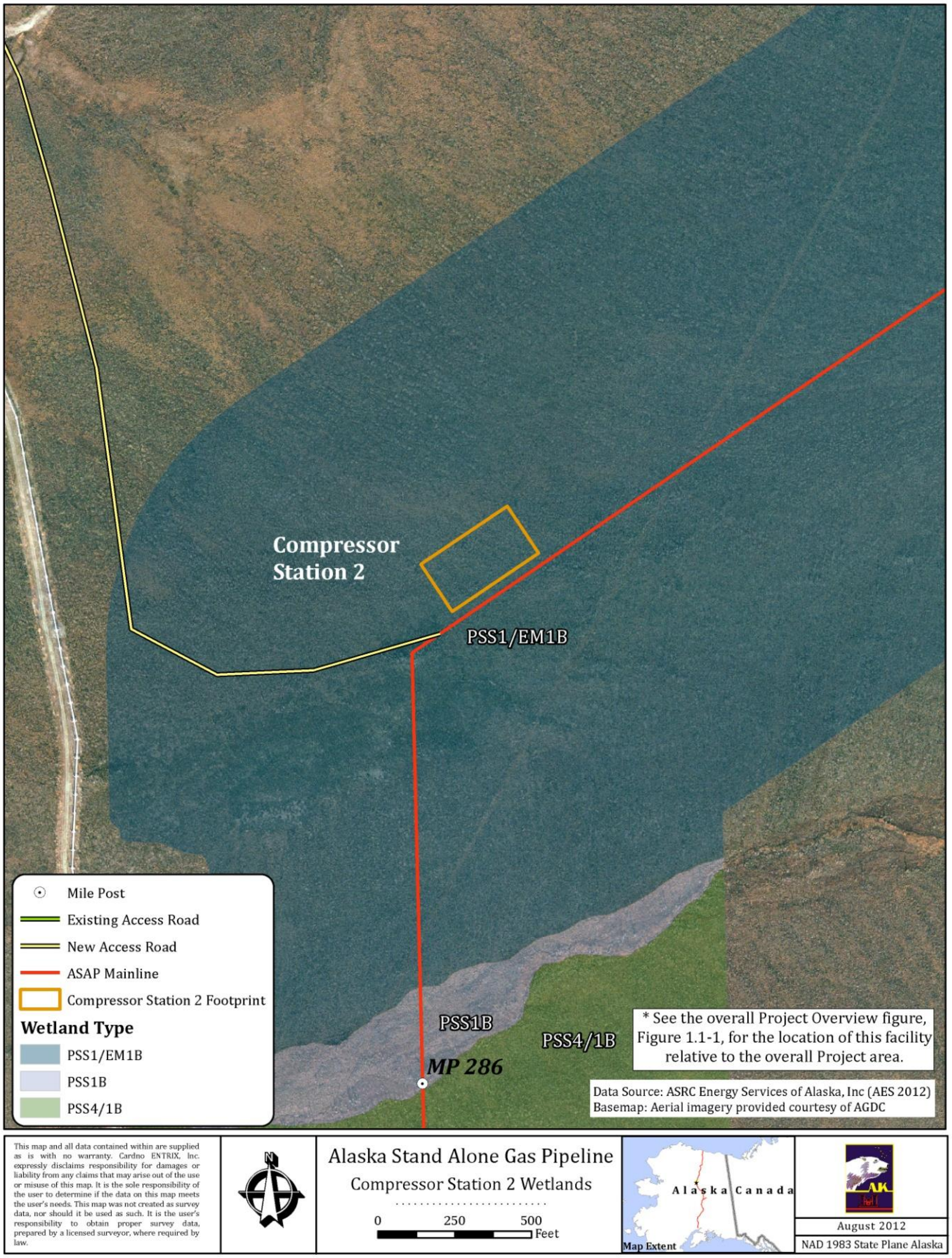

FIGURE 5.4-3 Compressor Station 2 Location Map with Wetlands Classified

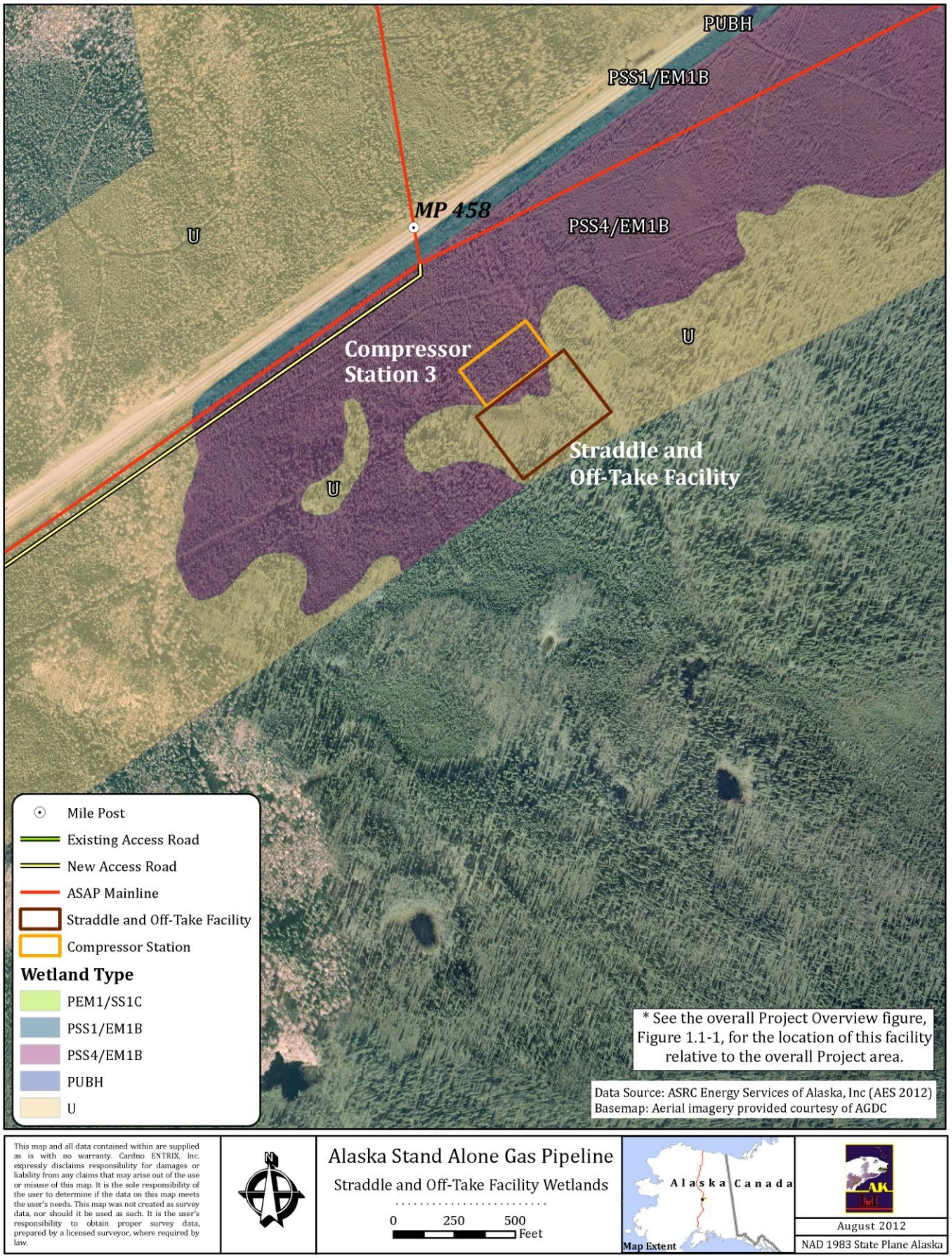

FIGURE 5.4-4 Straddle and Off-Take Facility Location Map with Wetlands Classified

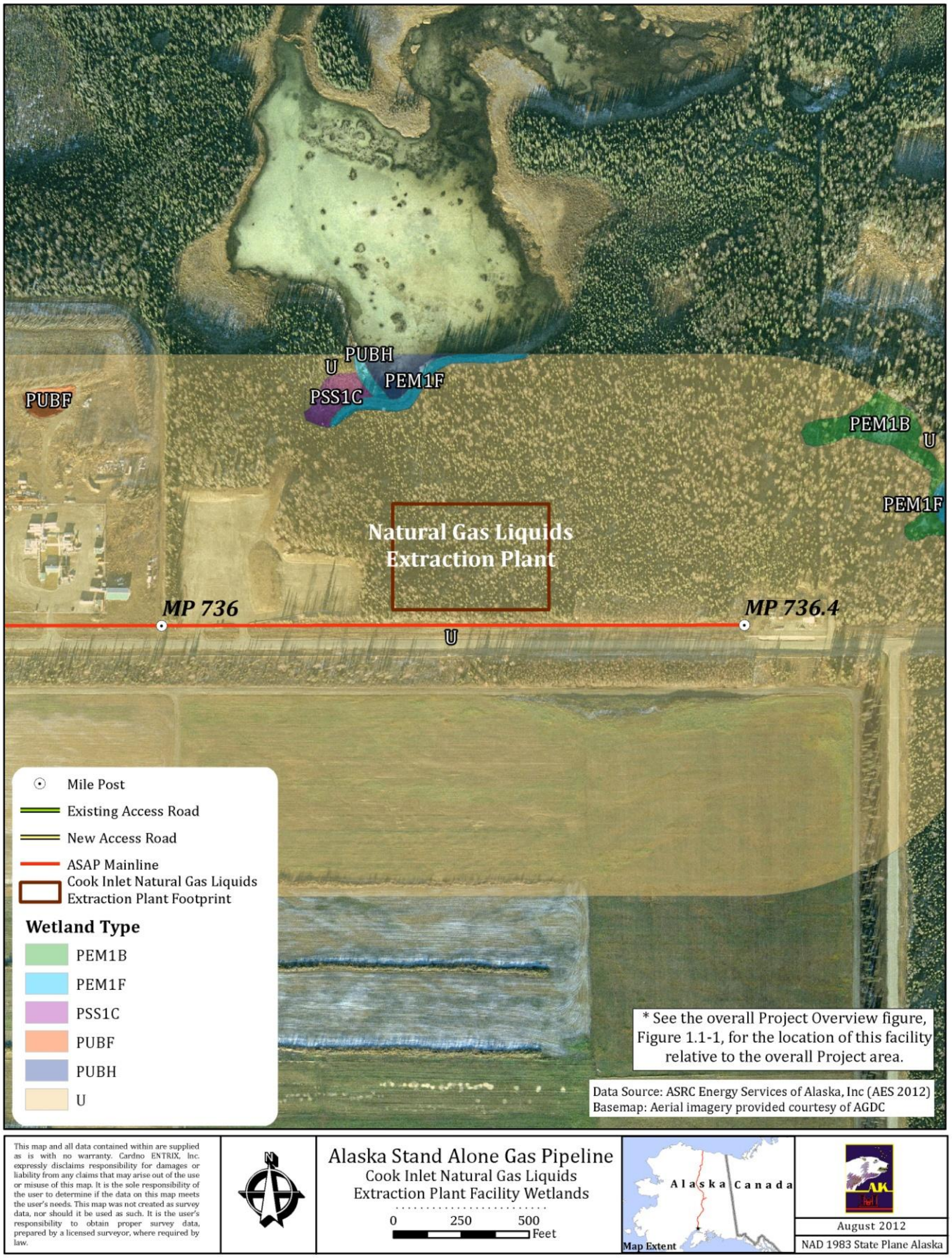

FIGURE 5.4-5 Natural Gas Liquids Extraction Plant Facility Location Map with Wetlands Classified

TABLE 5.4-1 Wetland Subgroups

Broadleaf Forest (PF01)	Needleleaf Forest (PF04)	Broadleaf Scrub/Shrub (PSS1)	Needleleaf Scrub/Shrub (PSS4)	Mixed and Other Scrub/Shrub (PSS)	Emergent Wetlands (PEM)	Palustrine Waters (POW)	Riverine Waters (R)	Lacustrine Waters (L)
PFO1/SS1B	PFO4/EM1B	PSS1/4B	PSS4/1B	PSS3/EM1B	PEM1/FO4B	PUB/EM1Fx	R2UBH	L1UBH
	PFO4/SS1B	PSS1/4C	PSS4/1C	PSS3/FO4B	PEM1/SS1B	PUB/EM1Hx	R2USC	L1UBHx
	PFO4/SS1C	PSS1/EM1B	PSS4/3B		PEM1/SS1C	PUB/EM1F	R3UBH	
	PFO4/SS4B	PSS1/EM1Bx	PSS4/EM1B		PEM1/SS1E	PUB/EM1H	R3US/SS1C	
	PFO4B	PSS1/EM1C	PSS4/EM1C		PEM1/SS1H	PUBF	R3USC	
	PFO4C	PSS1/EM1F	PSS4/FO4B		PEM1/SS1Cx	PUBFx	R4SBC	
		PSS1/FO4B	PSS4B		PEM1/SS1F	PUBH	R4SB	
		PSS1/FO4C	PSS4C		PEM1/SS3B	PUBHx	R2UBHx	
		PSS1/SS4B	PSS4/1E		PEM1/SS4B	PUB/ABH	R3UB/USC	
		PSS1/USC	PSS4/EM1F		PEM1/SS4C	PAB/EM1F	R3UB/USH	
		PSS1B	PSS4E		PEM1/USBx	PAB/EM1H		
		PSS1Bx			PEM1/USC	PAB/SS1F		
		PSS1C			PEM1B	PABF		
		PSS1Cx			PEM1Bx	PABH		
		PSS1F			PEM1C	PML1/SS1B		
		PSS1/4E			PEM1Cx	PUB/SS1F		
		PSS1/EM1Cx			PEM1F	PUB/SSIH		
		PSS1/EM1E			PEM1Fx			
		PSS1/EM1H			PEM1H			
		PSS1E			PEM1Hx			
		PSS1Fx						
		PSS1H						

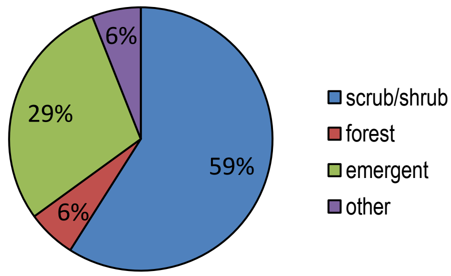

FIGURE 5.4-6
NWI Class of Wetlands
within the 2,000-Foot Wide Planning Corridor

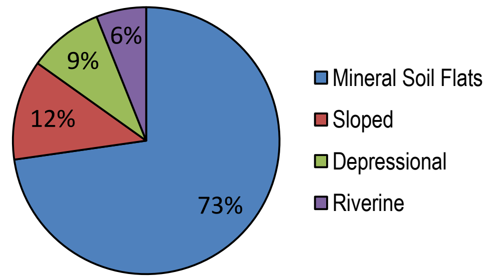

FIGURE 5.4-7
HGM Functional Class of Wetlands
within the 2,000-Foot Wide Planning Corridor

5.4.2.2 100-Foot-Wide Construction ROW and TEWS

Field work areas for wetland determinations were limited to specific field target locations within the 300-foot wide corridor (150 feet on either side of the center line) for analysis of the uplands and wetlands (AES 2012). The 300-foot wide corridor enables a buffer for adjustment of the proposed 100-foot wide mainline construction ROW alignment to avoid wetlands when possible. The total amount of wetlands resulting from the analysis within the 300-foot wide corridor was 12,993 acres, or 46 percent of the total area (AES 2012). Actual widths used to determine wetland composition in the construction ROW (Figures 5.4-8 and 5.4-9) were primarily 100-feet wide.

Beyond those lands within the construction ROW, additional construction areas, or TEWS, would be required for construction at road crossings, railroad crossings, crossings of existing pipelines and utilities, stringing truck turnaround areas, wetland crossings, points of inflection (PIs), and waterbody crossings. These TEWS would be located adjacent to the construction ROW and could be used for such things as spoil storage, staging, equipment movement, material stockpiles, and pull string assembly associated with Horizontal Directional Drilling (HDD) installation. These areas include: Atigun Pass, Dietrich River/Chandalar Shelf, Cathedral Mountain, Minto Flat Area, Denali National Park and Preserve (NPP), Panorama Peak, and Reindeer Hills-Cantwell (AES 2011). TEWS would be located in areas that reduce impacts to wetlands to the extent practicable. TEWS are described in further detail in Section 2.1.3.3.

The percent composition below is indicative of all segments of the pipeline including the Fairbanks Lateral and Denali National Park Route Variation. Results indicate that the construction ROW has 62 percent scrub/shrub wetlands, 30 percent emergent, 5 percent were forested, and 3 percent were other wetlands classes using the NWI classification system (Figure 5.4-8). Seventy-eight percent of the wetlands have a HGM function of mineral soil flats, with slope and depressional resulting in 12 percent and 6 percent respectively as the next most abundant functional classes (Figure 5.4-9). All ROW wetland acreage calculations were completed by Cardno ENTRIX using spatial analysis from AES 2012 data.

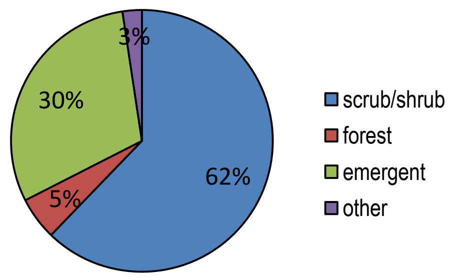

FIGURE 5.4-8
NWI Class of Wetlands within the Construction ROW

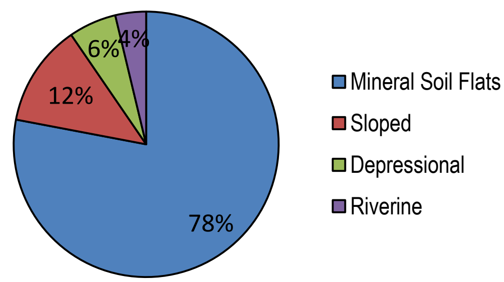

FIGURE 5.4-9
HGM Functional Class of Wetlands within the Construction ROW

5.4.2.3 Permanent ROW (Variable Width)

The permanent ROW width varies between 30, 51, and 52 feet, depending on the land ownership of the pipeline segment (Section 2.1.3.1). Pipeline segments that cross federal lands would maintain a 51 or 52 foot ROW; however, non federal land segments would require a 30 foot ROW (Section 2.1.3.1). The percent composition shown in Figures 5.4-10 and 5.4-11 is indicative of all segments of the pipeline including the Fairbanks Lateral and Denali National Park Route Variation. Approximately 66 percent of the wetlands in the permanent ROW are scrub/shrub, 26 percent are emergent, 6 percent are forested, and 2 percent are other (Figure 5.4-10). Seventy-five percent of the wetlands have a functional class of mineral soil flats, 17 percent are slope, 5 percent are depressional, and 3 percent are riverine (Figure 5.4-11). The variable width ROW wetland acreage calculations were completed by Cardno ENTRIX using spatial analysis from AES 2012 data.

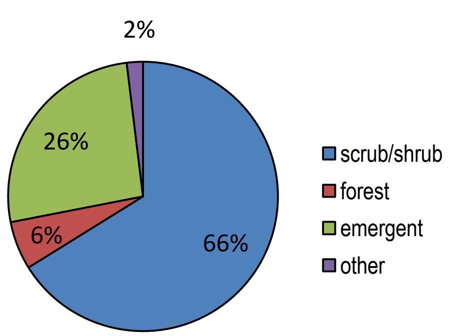

FIGURE 5.4-10
NWI Class of Wetlands within the Permanent ROW

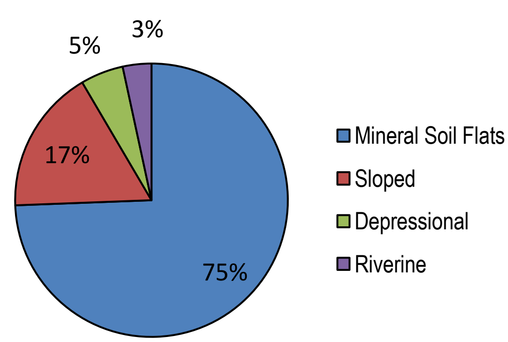

FIGURE 5.4-11
HGM Functional Class of Wetlands within the Permanent ROW

5.4.3 Environmental Consequences

5.4.3.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed; therefore, there would be no impacts to wetland resources.

5.4.3.2 Proposed Action

This section describes the potential impacts to wetlands during proposed Project construction activities (ROW and aboveground facilities), permanent operations and maintenance. It includes the alternatives and options considered and the types of activities that would be expected to occur during each phase of the proposed Project. Approximately 11,944 acres would be required temporarily for construction of the proposed Project. This includes the construction ROW, aboveground facilities, access roads, and TEWS outside of the ROW. Land retained for permanent easement would be approximately 4,149 acres. Additional wetland determinations would be completed in order to comply with permit requirements.

Pipeline Right-of-Way

Construction ROW

The proposed construction ROW (not including TEWs) for the mainline and the Fairbanks Lateral would affect approximately 4,826 acres of wetlands (Table 5.4-2) throughout its length. Approximately 145 acres of this total would occur in the Minto Flats State Game Refuge. The AGDC plans to target construction efforts in wetland areas during the winter months when possible (Section 2.2.3.2). Working in wetlands when the ground surface is frozen would substantially minimize impacts to the soil, water quality, vegetation, and wildlife use. The construction footprint would be minimized by grading directly over the centerline; construction and TEWS areas would occur on ice pads when possible to reduce heavy equipment impacts on surrounding wetlands. Dust deposition and non-native and invasive plant establishment would be reduced during the winter in contrast to summer construction.

Three main methods would be employed when constructing in wetlands: open-cut with matting, open-cut without matting, and open-cut push/pull. The horizontal directional drilling method would not be used when working in wetland areas. HDD is not a practicable method when constructing through large wetland areas; it is applicable primarily for short distances (5,000 – 6,000 feet). The HDD process requires additional temporary workspace which would impact additional wetland areas. In comparison, winter construction would reduce wetland impacts considerably.

The potential impacts discussed below are considered common to all pipeline segments, alternatives, options, aboveground facilities and extra work areas outside the ROW. Wetland NWI class and HGM functional classifications are identified by pipeline segment in acreage and percent composition in Tables 5.4-2 and 5.4-3 for the construction ROW.

TABLE 5.4-2 NWI Wetland Classes within the Construction ROW

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation[b]		MP 555-End	
Wetland Class[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
FORESTED WETLANDS										
Broadleaf Forest (PF01)	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.5	1.1%
Needleleaf Forest (PF04)	199.1	100.0%	8.7	100.0%	2.6	100.0%	0.0	0.0%	44.7	98.9%
Mixed Forest (PFO)	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Forested Wetlands (PFO)	**199.1**	**4.9%**	**8.7**	**2.6%**	**2.6**	**1.5%**	0.0	0.0%	**45.2**	**17.9%**
SCRUB SHRUB WETLANDS										
Broadleaf Scrub/Shrub (PSS1)	1,871.1	76.6%	115.6	42.9%	109.2	67.2%	1.5	100.0%	103.7	80.3%
Needleleaf Scrub/Shrub (PSS4)	571.5	23.4%	145.0	53.8%	53.3	32.8%	0.0	0.0%	25.4	19.7%
Mixed and Other Scrub/Shrub (PSS)	0.0	0.0%	8.7	3.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Scrub/Shrub Wetlands (PSS)	**2,442.6**	**60.1%**	**269.3**	**81.6%**	**162.5**	**91.7%**	**1.5**	**34.3%**	**129.1**	**51.1%**
EMERGENT WETLANDS										
Subtotal Emergent Wetlands (PEM)	**1,337.5**	**32.9%**	**49.6**	**15.0%**	**9.7**	**5.5%**	**0.5**	**10.2%**	**57.3**	**22.7%**
OTHER WETLANDS AND WATERS										
Palustrine Waters (POW)	14.4	16.6%	1.4	58.3%	0.8	0.5%	0.0	1.2%	7.2	34.4%
Riverine Waters (R)	70.6	81.3%	1.0	41.7%	1.7	1.0%	2.4	98.8%	13.6	65.1%
Lacustrine Waters (L)	1.9	2.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.1	0.5%
Subtotal Other Wetlands and Waters	**86.9**	**2.1%**	**2.4**	**0.7%**	**2.5**	**1.4%**	**2.4**	**55.5%**	**20.9**	**8.3%**
TOTAL										
All Wetlands and Waters	**4,066.1**		**330.0**		**177.3**		**4.4**		**252.5**	

[a] Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979).

[b] Denali National Park Route Variation source data is from preliminary data and mapping performed by AGDC and AES 2011.

Key: % Comp = Percent Composition is the percentage of each wetland subclass (broadleaf forest, needleleaf forest, etc.) within each primary wetland class (Forested Wetlands).

PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; P = Palustrine, R = Riverine; L = Lacustrine; OW = Open Water.

Note: Totals might not equal sums of values due to rounding.

All ROW wetland acreage calculations are derived from spatial analysis completed by Cardno ENTRIX (AES 2012).

Acreage calculations are based on Temporary Construction Easement (AGDC 2012).

Source: AES 2011.

TABLE 5.4-3 HGM Functional Class of Wetlands within the Construction ROW

Type[a]	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation[c]		MP 555-End	
	Acres	% Comp	Acres	% Comp	Acres	% Comp	Acres	% Comp	Acres	% Comp
Mineral Soil Flats	3,139.0	45.8%	316.5	4.6%	169.2	37.7%	0.3	0.0%	131.2	6.0%
Slope	597.5	8.7%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.9	0.1%
Depressional	170.2	2.5%	9.7	0.1%	6.5	1.4%	0.5	0.0%	93.6	4.3%
Riverine	148.1	2.2%	3.8	0.1%	1.7	.4%	2.7	1.0%	24.3	1.1%
Lacustrine Fringe	2.4	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.5	0.1%
Extended Peatlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Estuarine Fringe	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total [b]	**4,057.2**	**59.1%**	**330.0**	**79.1%**	**177.4**	**39.5%**	**3.5**	**1.9%**	**252.5**	**11.5%**

[a] Hydrogeomorphic classification (Magee and Hollands1998).

[b] Total acres and percent of segment that is wetlands. For specific wetland type, percent is also of the total segment.

[c] Denali National Park Route Variation source data is from preliminary data and mapping performed by AGDC and AES 2011.

Key: % Comp = Percent Composition is the percentage of each functional wetland type compared to the total of all functional wetland types combined.

Note: Total acres may not match those in Appendix tables due to rounding.

All ROW wetland acreage calculations are derived from spatial analysis completed by Cardno ENTRIX (AES 2012).

Acreage calculations are based on Temporary Construction Easement (AGDC 2012).

General visual wetland characteristics defined only by the presence of standing water or no standing water would determine what type of wetland crossing method AGDC would use. Relatively unsaturated wetlands (defined by visual characteristics only) do not possess standing water and may include forested and scrub/shrub wetland classes. These wetlands would be constructed via an open-cut method similar to upland vegetation (Section 2.2.2.2). This method may or may not use matting or geo-fabric and fill, depending on the level of soil stability. Geo-fabric matting would be used on unstable soils to limit impacts to unsaturated wetlands. Matting would disperse the weight of the heavy equipment use in wetland areas to prevent rutting and therefore erosion and sedimentation.

Wetlands with standing water (emergent and other wetland and waters classes) during the time of construction would primarily be constructed via the open cut/push-pull method (Section 2.2.3.2). Equipment would be placed on platforms and the pipeline would be strung across the wetland with floats via pushing or pulling it into place. The floats would then be removed and the pipeline would sink into place. To the extent possible, thawed unstable soils would be excavated during the winter season as a best management practice to minimize impacts to wetlands during construction.

Yukon River Crossing Options

Three pipeline options exist to cross the Yukon River. Construct a suspension bridge across the Yukon River (the Applicant’s Preferred Option), use the existing E.L. Patton Yukon River Bridge (Option 2), or use HDD (Option 3). Potential impacts to wetlands for the Applicant’s Preferred Option and Option 3 are expected to be the same during the construction and operation phase of the proposed Project because of the same area being impacted. All wetland data for the Yukon River Option 2 was obtained from the national wetland inventory database (USFWS 2011) and calculated by Cardno ENTRIX using spatial analysis.

The Applicant’s Preferred Option and Option 3 would result in approximately 12.7 acres of wetland impacts within the construction ROW whereas Option 2 would have 4.1 acres of impacts to wetlands. The overall additional impact of implementing Options 1 or 3 would result in 8.6 acres more impact to wetlands than Option 2. The acreage for each class includes: 2.5 acres emergent, 0.8 acre forested, 0.7-acre scrub/shrub, and 4.6 acres of other wetlands and waters (AES 2011). Option 2 impacts 3.9 acres scrub/shrub, 0.1 acres forest wetlands, and 0.1 acres of other wetland and waters (USFWS 2011).

The Applicant’s Preferred Option and Option 3 would result in approximately 4.0 additional acres of wetlands impacted within the permanent ROW than Option 2 (AES 2011, USFWS 2011). Impacts include mowing the vegetation along the ROW for inspection purposes throughout the life of the proposed Project. The acreage of each wetland class which would likely be impacted by maintenance of the permanent ROW for Option 1 and 3 would be: 1.2 acres emergent; 0.4 acre forested; 1.0 acre scrub/shrub; and 1.4 acres other wetlands and waters (AES 2011). Option 2 would impact 1.2 acres of scrub/shrub wetlands and 0.1 acres of forest wetlands (USFWS 2011).

Impacts to wetlands from the Applicant's Preferred Option and Option 3 would be from clearing and grubbing in wetlands on either side of the Yukon River and could potentially result in increased bank instability from removal of vegetation. Impacts could include accelerated soil erosion and sloughing of the bank. Vegetation would also be maintained to a non-forested cover type along the permanent ROW on either side of the Yukon River crossing for inspection purposes. For a discussion on additional resource impacts to the Yukon River from construction see Section 4.6, Fish and Section 4.2, Water Resources.

Grading and Trenching

Wetland construction would occur primarily during the winter months as noted above to minimize the extent of impacts to wetlands. Unlike construction within upland vegetation communities; clearing, grubbing and burning debris would not occur in wetland areas to limit impacts to wetlands. Grading would occur directly over the center line (trench line) of the pipeline to minimize disturbance to the wetland as much as possible. The vegetative mat would be separated from the subsoil for preservation of the root stock and vegetative cover before trenching. Temporary impacts could occur from top soil storage placement overlaid on neighboring wetlands to allow for equipment movement within the ROW. Impacts from trenching and blasting would include temporary disturbance to subsurface soil, topsoil, vegetation, and surface hydrology from heavy equipment use and excavation.

Construction of the ROW in wetland areas during the winter reduces impacts versus the summer construction season. There would be less likelihood to introduce non-native and invasive plant species into wetlands from equipment and personnel during the winter months. Although non-native invasive seeds are relatively resistant and would survive the winter, they may not establish and persist as quickly as in the summer months. Disturbance to aquatic vegetation and surface hydrology would be reduced due to working in stable (frozen) soil conditions and thus creating narrower trenches from higher soil stability. Ice pad and road development along the ROW would substantially reduce impacts to wetlands during construction. Erosion and soil compaction impacts would be temporary and minimized during the winter construction season because of ice road use. Migratory birds are absent during the winter and thus would not be impacted by temporary habitat loss or disturbance (as discussed in Section 5.5, Wildlife). Dust deposition would also be reduced in the winter construction period versus the summer as dust particles would be bound up within the frozen soil and snow and ice would cover gravel on roads further prohibiting fugitive dust dispersal.

Construction in wetlands during the summer months would produce impacts in addition to those that would occur during the winter construction period. All potential impacts to wetlands noted above that would be reduced in the winter construction period would be amplified during the summer. Additional impacts during summer construction include rutting, soil erosion, and increased exposure of recently disturbed soils to invasive plant species. Migratory birds and other wildlife would likely be present in the summer versus the winter construction period. Matting and geo-fabric would be used during the summer to mitigate for heavy equipment use to prevent soil erosion and drainage of wetland areas. AGDC would complete construction outside of sensitive wildlife habitat and time periods as much as practicable by constructing through wetlands in the winter.

Some wetlands classes would be expected to recover more quickly than others due to the length of time it would take for succession to occur. Scrub/shrub wetland disturbance could transform into an emergent wetland class temporarily from impounding effects until the vegetation recovers. This could alter wetland function temporarily and the recovery of this vegetation would be slow (likely decades). Forested wetland removal would result in much longer recovery (one hundred years or more) due to the loss of mature canopy and may also result in permanent loss.

Non-native and Invasive Plants

Proposed Project construction could propagate invasive and non-native wetland plants through multiple pathways:

- Transport and use of construction equipment and personnel from the continental United States where invasive and non-native wetland plants are common; and
- Spread of invasive and non-native wetland plants already associated with existing ROW's (the Alaska Railroad [ARR], the Trans Alaska Pipeline System [TAPS], and Highways) from construction equipment and personnel.

Invasive wetland plants (such as Canadian waterweed, didymo, and white sweet clover) are known invaders of Alaska's wetlands. These species thrive and establish quickly in recently disturbed wetland areas. These wetland plants are aggressive in growth and reproduction, are generalists, and are tolerant to many environmental conditions. Thus, they outcompete and displace native wetland vegetation once exposure allows establishment causing a reduction in biological diversity and community composition. Changes in the composition of wetland structure and function can in turn affect wildlife habitat (see Section 5.5, Wildlife).

Equipment and tools transported from other areas (outside of Alaska) could possess seeds and plant material of invasive and non-native species. Decontamination of all equipment previously exposed to invasive species would be required as a mitigation option to prevent further spread. Invasive and non-native wetland plants may be associated with existing highways or ROWs, which would create further invasion of non-native wetland plants. The majority of the proposed Project would parallel these highway corridors, and the spread of invasive and non-native wetland species could occur throughout the proposed Project's construction workspace. A robust Non-native Invasive Plants (NIP) Prevention Plan would be required to prevent further spread of invasive and non-native wetland plants. A *Revegetation Manual for Alaska* (Wright 2008) would be used as a guide to reduce NIP establishment as much as practicable.

Backfilling

The trench would be lined with fine grained material before pipe placement, filled with original subsoil, and then the vegetative mat would be placed on top to maintain natural strata. Preserving the vegetative root stock and soil strata in the wetland would be essential for the success of wetland recovery. The wetland would be contoured to its preconstruction state as close as possible after backfilling is complete.

Dust Deposition

Heavy equipment (such as dump trucks) used for transporting fill from material sites to construction areas would contribute additional dust along roadsides. Heavy equipment vehicles would produce more dust on gravel roads than regular passenger vehicles. Dust may also be produced from the material content (sand, gravel) being hauled in the bed of these heavy vehicles. Numerous trips would be made between material sites and the construction areas daily.

Dust deposition from construction would be temporary and localized due to the timing sequence of construction activities by pipeline segment. Dust deposition on wetlands would be reduced during the winter construction period versus the summer, since gravel roads are drier in the summer and wind processes would transport dust particles further. Whereas in winter, ice roads, pads and snow covered gravel roads would substantially reduce dust production.

Rehabilitation

Rehabilitation of the area would include clean up of the construction debris such as timber mats, geo-fabric, and fill, and the ROW would be contoured as close as possible to preconstruction conditions. During the post-construction phase, the construction ROW area would likely revert to a wetland type and function, similar to what had existed prior to the proposed Project implementation with the exception of forested wetland types. Forested wetlands cleared of their mature vegetation would result in a different wetland type and function than what had existed previously. Wetlands impacted along the construction ROW would be expected to recover to an early successional stage quickly as ADNR approved native and non-native seed is planted over the backfilled grade. The AGDC would consult with BLM and follow ADNR's *Plant Materials Center Revegetation Manual for Alaska*, and the Stabilization, Rehabilitation and Restoration Plan would be used as a guide for seed application and fertilization.

Disturbed soils are optimal locations for invasive plants as noted above. Invasive seeds could be transferred from equipment completing final grading of contours onto exposed wetland soils along the ROW. Alaska regulations only prohibit movement of material containing prohibited noxious weeds. Restricted noxious weed seed are permissible for planting in Alaska up to the tolerance per pound established under 11 AAC 34.020(b). An agency approved NIP Prevention Plan would be enforced and maintained as a mitigation measure to prevent the spread of invasive wetland species.

Fragmentation

The linear nature of the proposed Project has the potential to divide wetland systems, disrupting or altering vegetation, subsoil, and hydrology. Fragmentation in wetlands would occur temporarily during the post-construction phase of the proposed Project and could persist, dependent on the success of Best Management Practices (BMPs). Water logging could occur due to substantial disturbance to the active peat layer, resulting in reduced water infiltration.

Wetland hydrology could be impacted by changes to the thermal regime of the subsoil from laying pipe (frost penetration in winter) and potential erosion from thaw in the summer. Opportunistic plant species could invade the disturbance areas and persist if not extirpated. Impacts could occur based on the tolerance of wetland species to the potential changes in hydrology, soils, and the thermal regime. Replacing excavated materials in the same sequence that they were originally found during backfilling activities would be imperative to maintain the hydrology of the active layer and vegetative growth of the wetland. If BMPs are successful, it would be expected that once soils subside over the buried pipeline, surface hydrology would likely resume and disturbed vegetation would recover.

The pipeline would be buried to the appropriate depth, consistent with Alaska Department of Transportation and Public Facilities (DOT&PF) standards, for its entire length, with the exception of the mainline valves (MLVs). MLVs would function as locations where flow of gas could be restricted or stopped for maintenance, safety, or operational purposes. MLVs would be placed every 20 miles on reinforced concrete pads with associated work pads and access roads (AGDC 2011). Burial of the pipeline should allow wetland vegetation to reestablish and surface flow to function naturally over the construction ROW. Slope wetlands often occur along elevation gradients and have the greatest potential of the wetland types for being impacted by subsurface soil disturbances. Changes in the permeability of the surface or subsurface soil of a slope wetland could result in increased drainage and altered functionality, temporarily or permanently. The use of the original excavated material as backfill would be essential to maintain the natural function and structure of the wetland. Foreign material used as fill in the trench line could cause additional fragmentation impacts from discontinuity of the subsurface material. This in turn could alter vegetative growth if the subsurface soils are discontinuous. As stated in Section 2.2.2.5, original material excavated from the trench would be used as backfill as much as would be practicable. Ice road and pad development is not expected to fragment wetlands if BMPs are adhered to throughout the winter construction season. Ice roads and pads would be established over existing vegetation and would melt during break up.

Soil Compaction and Erosion

Construction of the ROW could compact soils along the ROW from heavy equipment access which could inhibit seed germination, reduce water infiltration, inhibit root establishment, and result in bare soil exposure. Soil erosion and fill placement could lead to increased sedimentation and turbidity in nearby waterbodies, which could then reduce water storage capacity, smother vegetation, and decrease oxygen concentration. These effects would be particularly applicable in areas of steep terrain and could extend beyond the construction ROW. Soil erosion could also alter water flow rates into and out of wetlands, thereby impacting local hydrologic processes. However, soil compaction and erosion impacts would likely be localized and temporary because timber and geo-textile mats would be used during the summer construction season to minimize the impacts to wetlands. Timber mats and geo-fabric disperse the weight of the heavy equipment use across the ground. Ice roads and pads would be developed for use in the winter, with wide tracked vehicles which would also disperse the weight of the equipment over wetlands.

Permanent ROW

Wetland vegetation would persist in the permanent ROW; however, functional characteristics could be altered by maintenance activities. Approximately 1,862 acres of wetlands would be impacted by the permanent ROW (not including TEWs) for the mainline and the Fairbanks Lateral (Table 5.4-4). Of this total, approximately 43.6 acres of wetlands would be permanently affected within the Minto Flats State Game Refuge. The impacts discussed below are considered common to all segments of the pipeline as well as all options and alternatives. Wetland NWI class and HGM functional classifications are identified by pipeline segment in acreage and percentage composition in Tables 5.4-4 and 5.4-5 for the permanent ROW.

Mowing

Regular maintenance of the permanent ROW would include mowing 1,862 acres of wetland vegetation to a non-forested vegetative cover type. This would allow visual inspections of the pipeline during aerial patrols in order to identify areas of concern. Forested wetlands within the permanent ROW would be permanently removed and likely convert to a scrub/shrub, emergent, or other wetland type. Approximately 107 acres (Table 5.4-4) of forested wetlands along the mainline ROW would be permanently altered; however, these areas would function as a different wetland type. Forested wetland vegetation areas outside of the permanent ROW but inside the construction area would reestablish through succession to forest vegetation over a long period of time (one hundred years or more).

Slope wetlands would be the HGM wetland class most susceptible to a change in function resulting from the clearance of forested vegetation. The lack of vegetation could alter water holding capacity, a function that would be slow to recover. Thus, clearing of slope wetlands would result in a long-term and in many instances permanent impact. The majority of slope wetlands exist in the MP 0 to MP 540 segment of the ROW (Table 5.4-5).

The spread of non-native and invasive plant species could occur from transporting and traversing the mowing equipment from one location to another along the ROW. A NIP Prevention Plan would include this aspect of the proposed Project to reduce the potential spread of invasive plants.

Mowing of the permanent ROW may allow motorized access of all terrain vehicles (ATVs) to wetland areas that were previously inaccessible. However, the proposed Project would be collocated with existing ROWs (highways, the TAPS ROW, and utility lines) the majority of it length; therefore, additional access to wetlands would be minimal.

TABLE 5.4-4 NWI Wetland Classes within the Permanent ROW (variable width)

	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation[b]		MP 555-END	
Wetland Class[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
FORESTED WETLANDS										
Broadleaf Forest (PF01)	0.0	0.0%	0.0	0.0%	0.0	0.4%	0.0	0.0%	0.2	1.4%
Needleleaf Forest (PF04)	90.5	100.0%	2.9	100.0%	0.3	7.8%	0.0	0.0%	13.8	98.6%
Mixed Forest (PFO)	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Forested Wetlands (PFO)	**90.5**	**5.4%**	**2.9**	**2.9%**	**0.3**	**8.2%**	**0.0**	**0.0%**	**14.0**	**18.2%**
SCRUB SHRUB WETLANDS										
Broadleaf Scrub/Shrub (PSS1)	835.4	76.6%	33.2	40.4%	13.9	58.8%	0.1	100.0%	31.6	80.2%
Needleleaf Scrub/Shrub (PSS4)	254.8	23.4%	46.3	56.4%	6.5	24.5%	0.0	0.0%	7.8	19.8%
Mixed and Other Scrub/Shrub (PSS)	0.0	0.0%	2.6	3.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Scrub/Shrub Wetlands (PSS)	**1090.2**	**65.6%**	**82.1**	**81.9%**	**20.4**	**82.9%**	**0.1**	**11.1%**	**39.4**	**51.3%**
EMERGENT WETLANDS										
Subtotal Emergent Wetlands (PEM)	**453.9**	**27.3%**	**14.7**	**14.7%**	**1.5**	**6.50%**	**0.2**	**22.2%**	**16.3**	**21.2%**
OTHER WETLANDS AND WATERS										
Palustrine Waters (P)	4.8	17.4%	0.2	40.0%	0.1	0.4%	0.0	0.0%	2.4	33.8%
Riverine Waters (R)	22.3	80.8%	0.3	60.0%	0.2	0.8%	0.6	100.0%	4.7	66.2%
Lacustrine Waters (L)	.5	1.8%	0.0	0.0%	0.0	0.0%	0.0	0.0%	<0.1	0.0%
Subtotal Other Wetlands and Waters	**27.6**	**1.7%**	**0.5**	**0.5%**	**0.3**	**1.2%**	**0.6**	**66.7%**	**7.1**	**9.2%**
TOTAL										
All Wetlands and Waters	**1,662.2**		**100.2**		**22.5**		**0.9**		**76.8**	

[a] Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979).

[b] Denali National Park Route Variation source data is from preliminary data and mapping performed by AGDC and AES 2011.

Key: PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; P = Palustrine, R = Riverine; L = Lacustrine.

% Comp = Percent Composition is the percentage of each wetland subclass (broadleaf forest, needleleaf forest, etc.) within each primary wetland class (Forested Wetlands).

Note: Totals might not equal sums of values due to rounding.

All ROW wetland acreage calculations are derived from spatial analysis completed by Cardno ENTRIX (AES 2012).

Source: AES 2012.

TABLE 5.4-5 HGM Functional Classes of Wetlands within the Permanent ROW (variable width)

Type[a]	MP 0-MP 540		Fairbanks Lateral		MP 540-MP 555		Denali National Park Route Variation[c]		MP 555-END	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Mineral Soil Flats	1,223.4	47.1%	96.1	3.7%	21.2	37.5%	0.0	0.0%	40.0	6.0%
Slope	316.9	12.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.7	0.1%
Depressional	62.5	2.4%	2.8	0.1%	1.0	1.8%	0.0	0.0%	28.0	4.2%
Riverine	54.0	2.1%	1.1	0.0%	0.2	0.4%	0.7	1.1%	7.7	1.2%
Lacustrine Fringe	0.6	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.4	0.1%
Extended Peatlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Estuarine Fringe	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total [b]	**1,657.4**	**63.9%**	**100.0**	**79.9%**	**22.4**	**39.6%**	**0.7**	**1.2%**	**76.8**	**11.6%**

[a] Hydrogeomorphic classification (Magee and Hollands 1998).

[b] Total acres and percent of segment that is wetlands. For specific wetland type, percent is also of the total segment.

[c] Denali National Park Route Variation source data is from preliminary data and mapping performed by AGDC and AES 2011.

Note: Total acres may not match those in Appendix tables due to rounding.

All ROW wetland acreage calculations are derived from spatial analysis completed by Cardno ENTRIX (AES 2012).

Source: AES 2012.

Climate Change

Future wetland loss could occur from changes to the climate over the next 20 to 100 years. Twentieth century climate records show that the United States is generally experiencing a trend towards a wetter, warmer climate; some climate models suggest that this trend will continue and possibly intensify over the next 100 years (Burkett and Kusler 2000). Permafrost wetlands and peatlands are the most likely wetland types found within the proposed Project area that would be affected by climate changes in association with atmospheric carbon enrichment. Climate change would include sea level rising, and storm surges; however, there are no estuarine wetlands within the proposed Project footprint. Global climate change could alter hydrologic parameters upon which wetlands and the species that inhabit them depend (IPCC 1995). Potential impacts range from changes in wetland community structure to changes in ecological function, and from extirpation to enhancement (Burkett and Kusler 2000). Climate change impacts on inland aquatic ecosystems would be caused by the direct effects of rising temperatures and rising CO_2 concentrations to indirect effects caused by changes in the regional or global precipitation and the melting of glaciers and ice cover (IPCC 2007). Potential impacts to wetlands from global climate change determined by IPCC (2007), and Bates, et al. (2008) is summarized below:

- Many wetlands have world conservation status and their loss could lead to significant extinctions, especially among amphibians and aquatic reptiles;
- Some of the most vulnerable wetlands regions include: Arctic and sub-Arctic ombrotrophic (‘cloud-fed’) bogs, and depressional wetlands with small catchments;
- Invertebrates, waterfowl, and tropical invasive species are likely to shift poleward with some potential extinctions;
- Enhanced UV-B radiation and increased summer precipitation will significantly increase dissolved organic carbon concentrations, altering major biogeochemical cycles;
- Numerous arctic lakes will dry out with a 2-3°C temperature rise;
- The seasonal migration patterns and routes of many wetland species may change and some may be threatened with extinction;
- Small increases in the variability of precipitation regimes will significantly impact wetland plants and animals at different stages of their life cycles;
- Changes in climate and land use will place additional pressures on already-stressed ecosystems along many rivers in the world; and
- Expansion in range for many invasive aquatic weeds.

Additional impacts to wetlands from climate change noted by Jon Kusler (2006) include:

- Flora and fauna in wetlands are more sensitive to changes in water levels than those of lakes, rivers, and streams;
- Lowering long-term water levels even a few inches can be the difference between a wetland or dry ground;
- Wetlands have been cut off from other wetlands by dams, dikes, roads, and other alterations so wetland plants and animals cannot migrate to other wetlands in response to changes in temperature or water levels; and
- Mankind has already stressed wetlands which has reduced the biodiversity. A reduced biodiversity makes wetlands more vulnerable to small changes in temperature and water levels.

Potential wetland impacts described above from climate change could be enhanced by proposed Project development due to additional road development which could fragment habitat and the potential for NIP establishment.

Aboveground Facilities

Construction of the pipeline ROW, construction camps and storage yards totaling approximately 7,795 acres would be returned to preconstruction uses (AGDC 2011). Additionally, approximately 80 acres would be required for aboveground facilities during construction and operations (Section 2.1.2). Development of aboveground facilities (including the Gas Conditioning Facility (GCF), compressor stations, and straddle off-take facility) would result in permanent loss of wetland habitat.

Approximately 4,149 acres of permanent aboveground easement (pipeline ROW and aboveground facilities) would be required for proposed Project operations (Section 2.1.3). Permanent aboveground facilities include one gas conditioning facility, one natural gas liquid extraction plant (NGLEP) facility, up to two compressor stations, three meter stations, 37 MLVs, and five pig launcher and/or receiver facilities totaling approximately 80 acres (Section 2.1.2). The following includes a summary of the wetland impacts from permanent aboveground facilities and temporary disturbance.

Gas Conditioning Facility

The GCF at MP 0 would occupy 68.7 acres in the Beaufort Sea Coastal Plain ecoregion for pad and facility development (Table 5.4-6). The proposed area for the GCF would be composed almost entirely of flat emergent scrub/shrub wetlands, which would be permanently impacted by the proposed Project. Temporary disturbance to wetlands from GCF development includes fugitive dust deposition, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use. A potential impact from an accidental spill from pipeline rupture, as noted in Section 5.19.4, could include a small amount of NGLs not vaporizing and may migrate through the wetland soils and enter the ground water if spill cleanup was not implemented. This could result in a permanent impact to the surrounding wetland, but would be a rare occurrence, and localized dependant on the oil spill response clean up response time.

Compressor Stations

Two compressor station options are being considered, both of which would permanently impact local wetlands:

- Option 1 – Two compressor stations: one at MP 225 and one at MP 458; and
- Option 2 – One compressor station at MP 285.

Each compressor station would be constructed on a gravel pad and expected to occupy a 1.4 acre footprint. Within that footprint, different types of wetlands would be affected depending on the option chosen. For Option 1, the compressor station at MP 225 and MP 458 would likely impact flat scrub/shrub wetlands while the compressor station in Option 2 at MP 285 would likely impact flat scrub/shrub wetlands. The exact amount of wetland area impacted would depend on the final location of each compressor station, and these facilities would be located to avoid wetlands as much as possible. Temporary disturbance to wetlands from compressor station development would include fugitive dust deposition from construction activities and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Straddle and Off-Take Facility

A straddle and off-take facility would be located at the Fairbanks Lateral tie-in at approximately MP 458 near Dunbar. This facility would be collocated with a mainline compressor station and a gas metering station. These facilities would be built on a 4.7 acre gravel pad and would require a permanent gravel access road. The gravel pad and access road would permanently impact flat forested wetlands. The exact amount of wetland area impacted would depend on the final location of the facilities and the access road. The straddle and off-take facility would be located to avoid wetlands as much as possible. Temporary disturbance to wetlands would include fugitive dust deposition from construction activities, and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Cook Inlet NGLEP Facility

The Cook Inlet NGLEP Facility would be constructed near MP 736 at the terminus of the pipeline. This facility would be built on a permanent 5.2 acre gravel pad and accessed by a permanent gravel road. The exact location of this structure would be determined during facility design optimization. The location of this facility would not directly affect wetlands because it would be located in an upland vegetated area, but roads leading to the facility could cross or be adjacent to wetlands. Acreage for access road wetland impacts is included in Table 5.4-7. Temporary disturbance to wetlands would include fugitive dust deposition from construction activities and potential leaching of contaminants from fuel and chemical leaks into wetlands from heavy equipment and vehicle use.

Aboveground Facilities by Segment

The wetland acreage impacted by permanent aboveground facilities is listed in Table 5.4-6. The GCF would have the most impact to wetlands (68.7 acres) of all aboveground facilities. Wetlands would be filled and aboveground facilities constructed. All wetland impacts from aboveground facilities (up to 73.3 acres) would be permanent. The acreage for wetland impacts included in Table 5.4-6 is for the aboveground facilities footprint, and does not include access road acreage. Wetland impacts from access road use and development is discussed below.

TABLE 5.4-6 Aboveground Facilities Wetland Impacts (Acres)

Wetland Class	GCF	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Fairbanks Lateral Off Take Facility	Compressor Station (MP 458.1)	NGLEP Facility
Forested	0.0	0.0	0.0	0.0	0.0	0.0
Scrub/Shrub	0.0	1.4	1.4	0.4	1.4	0.0
Emergent	67.7	0.0	0.0	0.0	0.0	0.0
Other Wetlands and Waters	1.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**68.7**	**1.4**	**1.4**	**0.4**	**1.4**	**0.0**

Source: Wetland calculations were derived from spatial analysis completed by Cardno ENTRIX (AES 2012)

<u>Support Facilities</u>

Support facilities would be located in major centers like Fairbanks and Anchorage (Section 2.1.3.3), and are not expected to contribute to further permanent impacts to wetlands. It is likely that existing buildings within these centers would be utilized for proposed Project support. Additional work spaces discussed in the following section include access roads and material sites.

Access Roads

Approximately 647 acres of access roads (172 acres of wetlands and 476 acres of uplands) would be required for the proposed Project (AGDC 2012). Access road acreage includes new permanent gravel, temporary gravel, new temporary ice road, improvements to existing permanent gravel, and existing temporary gravel roads (Table 5.4-7). The majority of these access roads (73 percent) would be located between MP 0 and MP 540 (Section 5.9.1.4). Access roads would be developed for transport of equipment, workers, and materials as well as accessing water sources and aboveground facilities.

The proposed mainline construction ROW would require the use of 40 gravel and ice roads, 12 of which are existing roads (Section 2.1.3.3). These roads would be approximately 20 to 24 feet wide within a 50 foot wide ROW. Approximately 2 acres of wetlands would be impacted by new temporary access roads and 164 acres by new permanent access roads for the proposed Project. Most of the wetlands impacted by access roads (84 percent) are scrub/shrub wetlands, and 8 percent each for forested and emergent herbaceous wetland types (Table 5.4-7).

Of the 164 acres of wetlands that would be affected by the new permanent access roads, 6.8 of these acres would be located within the Minto Flats State Game Refuge. Most of the wetlands that would be affected by new permanent access roads within the Minto Flats State Game Refuge would be scrub/shrub wetlands (97 percent), with the remaining 3 percent consisting of forested wetlands.

Permanent access road placement through wetlands would have permanent direct impacts, consisting of a loss of wetland acreage, which would result in a loss of wildlife habitat (Section 5.5, Wildlife), and wetland function. Indirect impacts would include fragmentation, dust deposition on surrounding wetlands from road use, and non-native invasive species encroachment as discussed below.

TABLE 5.4-7 NWI Wetland Classes (Acres) impacted by Access Roads

Wetland Class[a]	New Permanent Gravel Road (Acres)	New Temporary Gravel Road (Acres)	New Temporary Ice Road (Acres)	Existing Permanent Gravel Road (Acres)	Existing Temporary Gravel Road (Acres)
Broadleaf Forest (PF01)	0.0	0.0	0.0	0.0	0.0
Needleleaf Forest (PF04)	13.6	0.14	0.0	0.0	0.0
Mixed Forest (PFO)	0.0	0.0	0.0	0.0	0.0
Subtotal Forested Wetlands (PFO)	**13.6**	**0.14**	**0.0**	**0.0**	**0.0**
Broadleaf Scrub/Shrub (PSS1)	46.4	0.24	0.0	0.35	0.0
Needleleaf Scrub/Shrub (PSS4)	93.9	0.34	0.0	3.69	0.0
Mixed and Other Scrub/Shrub (PSS)	0.0	0.0	0.0	0.0	0.0
Subtotal Scrub/Shrub Wetlands (PSS)	**140.3**	**0.58**	**0.0**	**4.04**	**0.0**
Subtotal Emergent Wetlands (PEM)	**9.6**	**0.0**	**1.4**	**1.42**	**0.0**
Palustrine Waters (POW)	0.04	0.0	0.0	0.0	0.0
Riverine Waters (R)	0.72	0.14	0.0	0.08	0.0
Lacustrine Waters (L)	0.0	0.0	0.0	0.0	0.0
Subtotal Other Wetlands and Waters	**0.76**	**0.14**	**0.0**	**0.08**	**0.0**
All Wetlands and Waters	**164.20**	**0.86**	**1.40**	**5.54**	**0.0**

[a] Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979).

Key: PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; P = Palustrine, R = Riverine; L = Lacustrine; OW = Open Water.

Note: Some operational and construction impact acres for the Fairbanks lateral access roads are the same because all Fairbanks access roads are permanent (no temporary roads).

Totals might not equal sums of values due to rounding.

Source: AES 2012 Access Road delineated wetlands. Acreage estimates include roadway coverage provided by AGDC and not complete 50 ft ROW.

Dust Deposition

Dust created during construction activities could be transported by wind processes and deposited into surrounding wetlands. Increased vehicle usage on existing gravel roads and the construction of new access roads and pads would create additional impacts. According to

Walker and Everett (1987), the most severe impacts to vegetation occurs within 10 meters of the road and include early snowmelt along roadsides, decrease in moss near the road, a decrease in soil lichens, and opening of ground cover. The level of impact to wetlands would be dependent on the placement of the roads in relation to wetlands present. Road dust landing on the snow adjacent to roadsides would cause accelerated snow melt. Snow melting earlier along roadsides versus snow that is not exposed to dust can result in exposing vegetation for wildlife feeding opportunities near the road and increased mortality could occur due to vehicle collisions with wildlife. The primary occurrence of dust deposition expected during operations of the proposed Project would be from regular vehicle use at aboveground facilities (GCF, compressor stations, meter stations, and mainline valves).

Dust deposition can have a variety of direct and indirect effects on wetlands. Physical effects of dust on plants could cause breakage and blockage of stomata, shading, and abrasion of leaf cuticle leading to photosynthesis inhibition. Increased dust in wetlands can also lead to increased sedimentation and water turbidity, diminished water storage capacity, and reduced oxygen concentrations. The chemistry of the dust could impact water and soil chemistry which could result in plant chemistry changes, altering species competition which in turn results in changes in community structure. Dust dispersal would be dependent on frequency of vehicle use, speed of travel, wetting of the ground, wind, topography, configuration of the road, and surrounding vegetation. Dust deposition impacts to wetlands would be localized and temporary during the construction ROW for access road and pad development. Impacts would be long term from regular vehicle use for proposed Project operations.

Physical and Chemical Processes

Development of access roads to connect aboveground facilities would cause surface hydrologic disturbance to the natural system. Disturbances could create surface impoundments if water flow is inhibited or could result in an increase in water outflow if natural impoundments degrade. Increased water impoundment would decrease water circulation resulting in increased water temperature, lower dissolved oxygen levels, changes in salinity and pH, altered nutrient outflow, and increased sedimentation (EPA 1993). Conversely, decreases in water impoundment could lower water tables, degrade peat layers, change vegetation, and ultimately result in a reduction or loss of wetland functions.

Thermokarst development could occur at impoundments in areas where permafrost is present. In thermokarst areas, soil temperatures rise with thaw depth, and primary productivity can shift the species composition from changes in soil characteristics. Culvert placement and frequency along roads would be a very important variable to allow natural drainage between wetlands, especially in highly saturated wetlands. This would apply to all areas including roads to facility pads where dust could be deposited on wetlands from vehicle use.

Altered water levels can change soil exposure and water-dependent plant species composition. Wetlands can become channelized from road development which can change the rate and character of surface flow (Darnell 1976). Erosion of soil in wetlands results in increased sedimentation and turbidity which affects photosynthesis of wetland plants.

Chemicals reaching wetlands from vehicle leaks and ice salting during winter months can change the water quality of adjacent wetlands. These chemicals can alter the soil's chemical composition, which can in turn alter species composition and richness.

Fragmentation

Construction of 60 new roads (30 acres) would create permanent fragmentation to wetlands that are crossed by the roads. Roads would be placed in the most practicable position to reduce impacts to wetlands. Wetland acreage affected by access road development would be relatively small in relation to the extent of available wetland habitat. Habitat fragmentation would impact the wildlife that is dependent on the type of wetland habitat being disconnected by road development. Habitat fragmentation is therefore gauged by the wildlife that uses wetlands as habitat. Fragmentation is not expected to occur in areas where ice roads are developed but could persist longer in areas with slow-growing or long-lived vegetation (i.e., forested), or in areas more susceptible to hydrologic modifications (i.e., slope wetlands). Habitat fragmentation is discussed in detail in Section 5.5, Wildlife.

Non-native and Invasive Plants

Development of roads could act as dispersal corridors for non-native plant species to invade areas previously inaccessible. Recently disturbed soils are the optimal environment for seeds to establish in wetland areas. Wetland species such as canary reed grass, cattail, and purple loosestrife are aggressive invaders of wetland areas that tend to dominate and out-compete native species. Species such as Canadian waterweed, didymo, and white sweet clover are other known invaders of Alaska's wetlands.

Impacts from invasive plants in pristine wetlands include altered diversity and abundance of native species since invasive plants out-compete native plants for breeding areas, nutrients, and soil. They can also disrupt food webs, degrade habitat and biodiversity. The extent and potential for invasion of non-native wetland species would be determined by implementation of a robust NIP Prevention Plan developed though agency consultations and approval.

Material Sites

Existing material sites used for the TAPS Project would provide sufficient gravel and sand for the proposed Project (Section 2.1.3.3). Impacts to wetlands from material site use include dust deposition during excavation and transport of material. Details on wetland location in relation to existing material sites will be determined later in the process as site specific details are defined for the proposed Project. No new material sites would be developed in the Minto Flats State Game Refuge. Potential impacts from material sites could include sedimentation and altered water quality temporarily, and altered wetland function permanently.

Dust deposition may have impacts to wetlands surrounding material sites when heavy equipment is mining gravel and sand to be transported to road and pad development points. These impacts would be minimal, temporary, and dispersed considering 546 existing material sites would be utilized to support the proposed Project. The majority of material sites are not expected to be more than 10 miles from the proposed Project (Section 2.1.3.3).

Temporary Extra Workspaces

TEWS would be located adjacent to construction areas and would include areas of land required for temporary uses. These areas may include areas for spoil storage, staging of equipment, pull string assembly, HDD activities, and railway crossing points (Section 2.1.3.3). In addition, they would include areas for road, streams, pipeline, and wetland crossings; access roads, block valve installation sites, and pig receiver and launcher sites.

The approximate NWI wetland composition for TEWs is included in Table 5.4-8 (AGDC 2012). Approximately 516 acres of wetlands and 465 acres of uplands would be potentially impacted for TEWS acreage totaling approximately 981 acres. The majority (87 percent) of the wetland impacts for TEWS would be located between MP 0 to MP 540 (Table 5.4-8). The wetlands impacted throughout the ROW area would include 70 percent scrub/shrub, 7 percent forested, 22 percent emergent and 1 percent other wetland type (Figure 5.4-12). Of the approximately 516 acres of wetlands that would potentially be affected by the TEWs, 17.9 acres would be located within the Minto Flats State Game Refuge. The majority (85.8 percent) of the wetlands affected in the Minto Flats State Game Refuge would be scrub/shrub, with 13.7 percent consisting of forested wetlands.

HGM wetland types are included in Table 5.4-9 below. The HGM wetland types impacted temporarily by TEWS include 76 percent mineral soil flats, 11 percent slope, 9 percent depressional, and 4 percent riverine (Figure 5.4-13). The location of TEWs would be situated in upland areas when feasible to reduce additional impacts to wetlands.

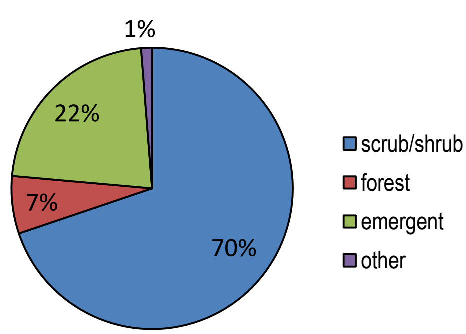

FIGURE 5.4-12
NWI Wetland Classes (percent) for TEWS along the proposed Project ROW

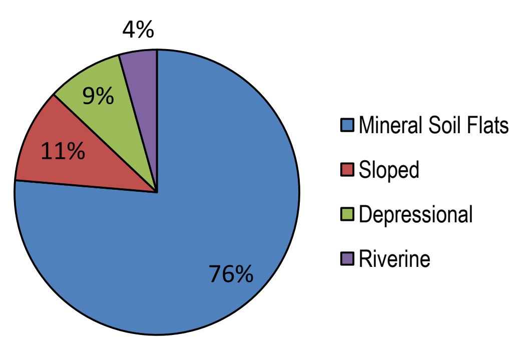

FIGURE 5.4-13
HGM Wetland Classes (percent) for TEWS along the proposed Project ROW

TABLE 5.4-8 NWI Wetland Classes within the Temporary Extra Workspaces (Acres)

	MP 0 - MP 540		MP 540 - MP 555		MP 555 - End		TOTAL	
Wetland Class[a]	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**	**Acres**	**% Comp**
FORESTED WETLANDS								
Broadleaf Forest (PF01)	0.0	0.0%	0.0	0.0%	0.5	6.1%	0.5	0.1%
Needleleaf Forest (PF04)	30.1	100.0%	0.5	100.0%	7.7	93.9%	38.3	7.4%
Mixed Forest (PFO)	0.0	0.0%	0.0	0.0%	0	0.0%	0.0	0.0%
Subtotal Forested Wetlands (PFO)	**30.1**	**6.6%**	**0.5**	**4.7%**	**8.2**	**15.7%**	**38.8**	**7.5%**
SCRUB SHRUB WETLANDS								
Broadleaf Scrub/Shrub (PSS1)	252.6	79.1%	5.0	49.0%	19.7	71.4%	277.3	53.7%
Needleleaf Scrub/Shrub (PSS4)	66.8	20.9%	5.2	51.0%	7.9	28.6%	79.9	15.5%
Mixed and Other Scrub/Shrub (PSS)	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Scrub/Shrub Wetlands (PSS)	**319.4**	**70.4%**	**10.2**	**95.3%**	**27.6**	**53.0%**	**357.2**	**29.1%**
EMERGENT WETLANDS								
Subtotal Emergent Wetlands (PEM)	**100.6**	**22.2%**	**0.0**	**0.0%**	**13.7**	**26.3%**	**114.3**	**22.1%**
OTHER WETLANDS AND WATERS								
Palustrine Waters (POW)	2.1	55.3%	0.0	0.0%	1.4	53.8%	3.5	0.7%
Riverine Waters (R)	1.7	44.7%	0.0	0.0%	1.2	46.2%	2.9	0.6%
Lacustrine Waters (L)	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Subtotal Other Wetlands and Waters	**3.8**	**0.8%**	**0.0**	**0.0%**	**2.6**	**5.0%**	**6.4**	**1.2%**
TOTAL								
All Wetlands and Waters	**453.9**		**10.7**		**52.1**		**516.7**	

Key: [1] Classification of Wetlands and Deepwater Habitats (Cowardin et al., 1979); PFO = Palustrine Forested; PSS = Palustrine Scrub/Shrub; PEM = Palustrine Emergent; L = Lacustrine; R = Riverine.
% Comp = Percent Composition is the percentage of each wetland subclass (broadleaf forest, needleleaf forest, etc.) within each primary wetland class (Forested Wetlands).
Totals might not equal sums of values due to rounding.
All wetland calculations were derived from spatial analysis completed by Cardno ENTRIX (AES 2012).
Acreage calculations are based on Temporary Extra Workspaces (AGDC 2012).
Source: AES 2012.

TABLE 5.4-9 HGM Wetland Types within the Temporary Extra Workspaces (Acres)

Type[a]	MP 0-MP 540		MP 540-MP 555		MP 555-End		TOTAL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Mineral Soil Flats	355.7	51.6%	10.8	36.7%	27.7	10.5%	394.2	40.1%
Slope	55.0	8.0%	0.0	0.0%	0.3	0.1%	55.3	5.6%
Depressional	24.9	3.6%	0.0	0.1%	19.6	7.4%	44.5	4.5%
Riverine	18.4	2.7%	0.0	0.0%	3.9	1.5%	22.3	2.3%
Lacustrine Fringe	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.5	0.1%
Extended Peatlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Estuarine Fringe	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total [b]	**454.0**	**65.9%**	**10.8**	**36.8%**	**52.0**	**19.7%**	**516.8**	**52.6%**

[a] Hydrogeomorphic classification (Magee and Hollands 1998).

[b] Total acres and percent of segment that is wetlands. For specific wetland type, percent is also of the total segment.

Note: Total acres may not match those in Appendix tables due to rounding.

All ROW wetland acreage calculations are derived from spatial analysis completed by Cardno ENTRIX (AES 2012).

Acreage calculations are based on Temporary Extra Workspaces (AGDC 2012).

Source: AES 2012.

5.4.3.3 Denali National Park Route Variation

The Denali National Park Route Variation would be located adjacent to the George Parks Highway and pass through Denali National Park lands, likely producing visual impacts when viewed from the Park. This route is currently not permissible under federal law, but would extend 15.3 miles through the Park avoiding designated wilderness areas. The Mainline route would start at MP 540 and extend 15 miles through the Denali Borough east of the Parks Highway (Figure 1.1-1).

Acreage for wetland impacts during construction and operations for the Denali National Park Route Variation and Mainline route is included in Table 5.4-2 and 5.4-4 respectively. The Denali National Park Route Variation would affect 4.4 acres of wetlands during construction and 0.9 acres of wetlands during the operational phase of the proposed Project. The Mainline route would affect 177.3 acres of wetlands for construction and 22.5 acres for permanent operations. As noted above, the wetland delineation data were removed from the PJD for the Denali National Park Route Variation. The preliminary data and mapping by AGDC and AES 2011 was analyzed to identify wetland impact acreages for the Denali National Park Route Variation.

The majority of wetlands impacted (55 percent) along the Denali National Park Route Variation during construction would be riverine, and 34 percent would be scrub shrub (Table 5.4-2). The types of wetland impacts noted above from construction activities of the Denali National Park Route Variation would also apply to the Mainline route. Ninety two percent of the wetlands impacted along the Mainline route would be scrub shrub (Table 5.4-4). The Denali National

Park Route Variation would have no impacts to forested wetlands. Impacts from wetland loss would affect wildlife that depends on wetland habitat in this area (Section 5.5, Wildlife).

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5.5 WILDLIFE

This section describes the terrestrial mammals and bird species that are not listed as endangered, threatened, or candidate species under the Endangered Species Act (ESA) of 1973 that inhabit the area along the proposed 737 mile proposed Project right-of-way (ROW). It includes the Fairbanks Lateral, aboveground facilities, support facilities, and the Denali National Park Route Variation. The wildlife discussed in this chapter are common species that inhabit the area associated with the proposed Project at some point in their life history (breeding, migration, feeding, nesting, calving, rearing, molting, and staging). Large and small terrestrial mammals, waterbirds, upland game birds, and land birds are discussed in detail below. The AGDC has proposed mitigation measures to reduce impacts to wildlife, which is included in Section 5.23.2.5.

5.5.1 Affected Environment

Terrestrial wildlife resources found along the proposed ROW were reviewed to determine if species are listed under the federal ESA, the Migratory Bird Treaty Act (MBTA), or the Bald and Golden Eagle Protection Act (BGEPA). Wildlife protected under the ESA is discussed in Section 5.8, Threatened and Endangered (T&E) Species. Regulations for species protected under the MBTA and the BGEPA are discussed below:

- Migratory Birds – Under the MBTA (16 U.S.C. 703), it is illegal for anyone to "take" migratory birds, their eggs, feathers, or nests. "Take" includes by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. In Alaska, all native birds except grouse and ptarmigan (protected by the State of Alaska) are protected under the MBTA. The destruction of active bird nests, eggs, or nestlings can result from mechanized land clearing, grubbing, and other site preparation and construction activities and would violate the MBTA. The U.S. Fish and Wildlife Service (USFWS) generally recommend that applicants comply with the MBTA by avoiding certain activities during the nesting season that could result in the "take" of birds during the nesting season (Table 5.5-2). USFWS has issued an information sheet that further describes these recommendations by location and habitat type (USFWS 2007a). The timing guidelines are not regulations, but are intended as recommendations to help proposed projects comply with the MBTA. Some species and their nests have additional protections under other federal laws (such as the bald and golden eagle). The AGDC would conduct an aerial raptor nest survey at the appropriate time (prior to leaf out) to document occupied nests within a specified buffer of the proposed Project ROW. Collaboration with USFWS would occur if an unavoidable take would be likely to occur from construction activities, which would require an Eagle Take Permit.
- Bald and Golden Eagles – Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) and their nests are protected by the BGEPA (16 USC 688–688d [a and b]). All parties working in the vicinity of eagles are responsible for avoiding the

taking, "at any time in any manner (of) any bald eagle…or any golden eagle... or any part, nest or egg thereof" (16 U.S.C. 688a). "Taking" is defined as to, "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" (16 U.S.C. 688a). During the nesting period (March 1 through August 31), eagles may be sensitive to noise and obtrusive human activity in the vicinity of nest sites. Eagle nests occurring in the vicinity of any project component, including borrow sources, roads, staging areas, etc. must be identified. Prior to conducting project activities that may cause disturbance of an eagle nests, it is necessary to contact the USFWS to determine measures to avoid and minimize potential eagle take. If a take is unavoidable, the USFWS has a permit process available that can authorize take where it is deemed necessary and appropriate. A list of guidelines to help minimize impacts to bald eagles includes: (1) keeping a distance between the activity and the nest (distance buffers), (2) maintaining preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and (3) avoiding certain activities during the breeding season (USFWS 2007b). Bald eagles are sensitive to a variety of human activities; however, not all bald eagle pairs react to human activities in the same way. This variability may be related to a number of factors, including visibility, duration, noise levels, extent of the area affected by the activity, prior experiences with humans, and tolerance of the individual nesting pair. Additional information on eagles and the BGEPA can be found at http://alaska.fws.gov/eaglepermit/index.htm.

- Alaska Department of Fish and Game (ADF&G) Game Management Units – The ADF&G developed 26 game management units (GMUs) to provide fair and equal hunting rights in all regions of Alaska. The proposed Project ROW crosses seven ADF&G GMUs from the Arctic Coastal Plain to the Cook Inlet in Southcentral Alaska (Figure 5.5-1). Most of the proposed Project mainline falls within four GMUs: GMU 20 (31 percent), GMU 26 (24 percent), GMU 24 (19 percent), and GMU 13 (11 percent) (see Table 5.5-1 and Figure 5.5-1). The remaining 15 percent is located within GMU's 14 (9 percent), 16 (4 percent) and 25 (2 percent), respectively (Table 5.5-1).

5.5.1.1 Wildlife Resources

Terrestrial mammals commonly found along the proposed Project ROW that are categorized as common terrestrial mammals include moose, caribou, and bears. Muskoxen are also present within limited areas in the Arctic Coastal Plain. The wood bison may potentially be introduced into the Yukon Flats National Wildlife Refuge area in the future. Common terrestrial mammals and their GMUs, habitat descriptions, and species abundance estimates are described in Table 5.5-2.

Waterfowl, game birds, shorebirds, and land birds that could occur within or near the proposed Project area are discussed in detail below (Tables 5.5-3 and 5.5-4). Information used to analyze avian use of the proposed Project area and surrounding, was obtained from the USFWS waterfowl breeding pair survey areas (Larned et al. 2010, Mallek and Groves 2009) and Alaska biogeographic regions (Armstrong 1990, Boreal Partners in Flight Working Group 1999, Rich et al. 2004).

Many animals are valued as game for subsistence, sport hunting, and trapping uses. Big and small game animals, furbearers, waterfowl, and upland game birds could occur within the proposed Project area year-round, with most sport hunting concentrated in the fall.

TABLE 5.5-1 ADF&G Game Management Units Crossed by the Proposed Project ROW

Game Management Unit	Subunit	Approximate Start Milepost	Approximate End Milepost	Approximate Length (mile)
Parks Highway Route				
26	B	0	174.8	174.8
25	A	174.8	180.7	5.9
24	A	180.7	322.2	141.5
25	D	322.2	329.5	7.3
20	F	329.5	398.3	68.8
20	B	398.3	476.0	77.7
20	A	476.0	502.1	26.1
20	C	502.1	535.2	33.1
20	A	535.2	562.0[a]	26.8
13	E	562.0	645.6	83.6
16	A	645.6	674.8	29.2
14	B	674.8	707.0	32.2
14	A	707.0	737.0	30.0
Total				737.0
Fairbanks Lateral[b]				
20	B	0	48.2	48.2
Total				48.2

[a] Multiple minor crossings into Game Management Unit 20C.
[b] Fairbanks Lateral begins at about Parks Highway Route Milepost 458.7.

TABLE 5.5-2 Recommended Time Periods to Avoid for Vegetation Clearing During Migratory Bird Breeding

Region	Habitat Type		
	Forest of Woodland [a]	Shrub or Open	Raptor and Raven Cliffs
Arctic	NA	June 1 – July 31 [c]	April 15 – Aug 15
Interior	May 1 – July 15 [b, d]		April 15 – Aug 1
South-central	May 1 – July 15 [b]		April 10 – Aug 10

[a] Owl species may begin to nest two or more months earlier than other forest nesters, and are fairly common breeders in forested areas of Alaska.
[b] Canada geese and swan habitat start nesting April 20.
[c] Black scoter habitat through August 10.
[d] Tern and gull colonies in the Interior Region.
Source: USFWS 2007a.

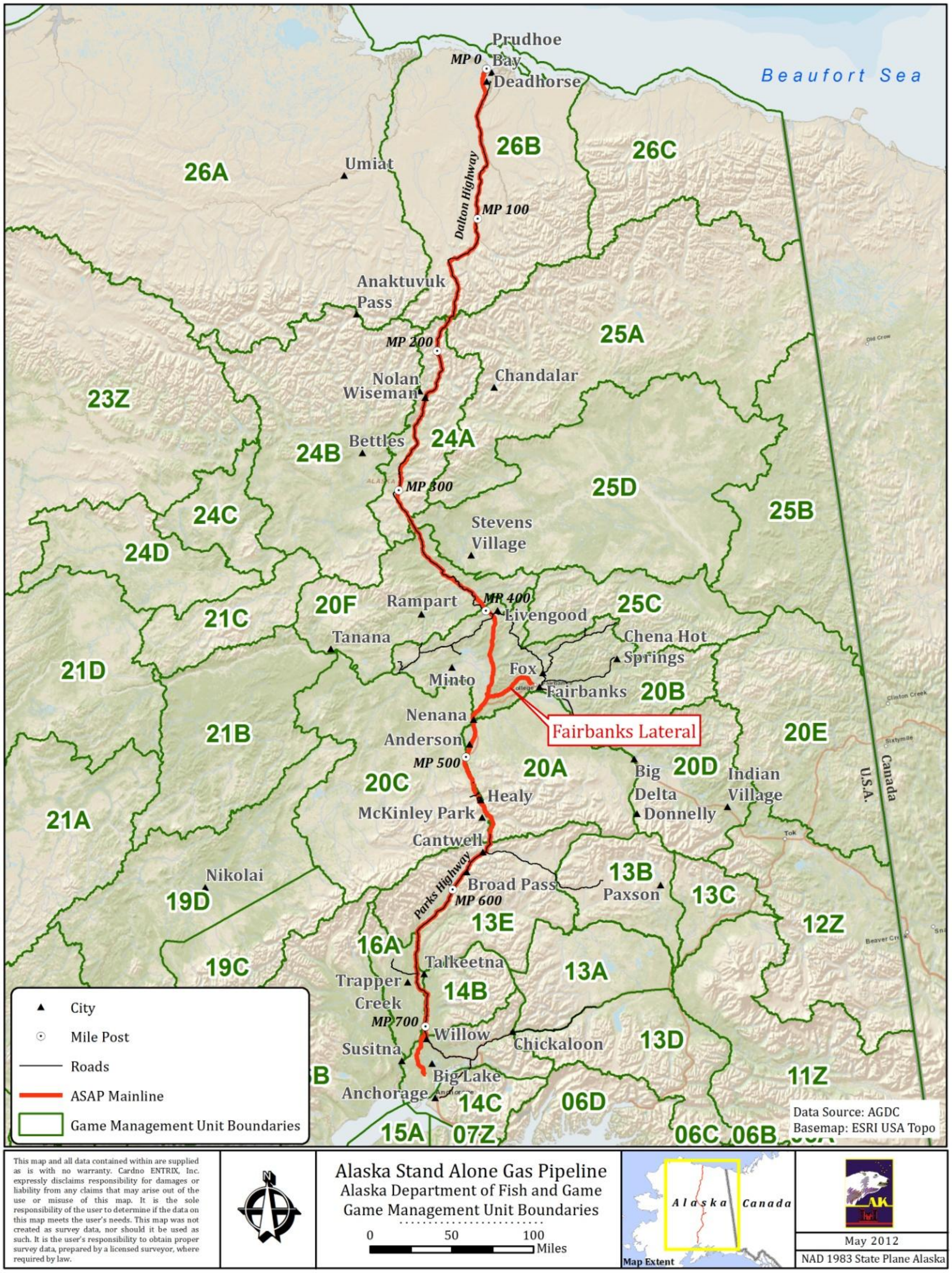

FIGURE 5.5-1 ADF&G Game Management Units Crossed by the Proposed Project ROW

TABLE 5.5-3 Common Terrestrial Mammals that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0- 174.8	25A,D MP174.8 -180.7; MP322.2 -329.5	24 MP180.7 -322.2	20A,B,C, D,F MP398.3- 562.0	13E	16A MP645.6 -674.8	14A,B MP674.8 -737.0	
Big Game Animals								
Moose (*Alces alces*)	√ ~450	√ ~2,200	√ ~8,500	√ ~46,000	√ ~4,500	√ ~1,600	√ ~8,000	Abundant and associated with a wide variety of forest, shrub, particularly willow, and wetland habitats. Traditionally move between mountains and adjoining lowlands on a seasonal basis. Wildfire important in improving forage (MacDonald and Cook 2009).
Caribou (*Rangifer tarandus*)	√ CA 66,800	√ P 100,000	√ RM 1,000	√	√ N		√ N 36,600	Caribou herds: CA – Central Arctic, P – Porcupine, RM – Ray Mountain, D – Delta, N – Nelchina. Social and nomadic, spring calving area traditional center of distribution and define herds, calving above timber line or along coast in windswept rolling hills. Summer ranges may seek high mountains or coast for relief from biting insects. May travel long distances to find adequate lichens, sedges, browse in boreal forest and tundra. Herds may mix on winter ranges(MacDonald and Cook 2009).
Muskoxen (*Ovibose moschatus*)	√ ~200							Social and gregarious, in summer uses moist habitats and riparian vegetation, in winter shifts to windswept hill-tops, slopes (MacDonald and Cook 2009).
Dall Sheep (*Ovis dalli*)	√ ~900	√ ~1,300	√	√ ~3,300	√	√	~1,300	Subalpine grass-low shrub habitats in dry, mountainous terrain; expand range during summer, restricted in late winter to snow-free areas; mineral licks essential during spring (MacDonald and Cook 2009).
Brown bear (*Ursus arctos*)	√ ~270	√ ~860	√ ~850	√ ~650	√ ~1,300	√ ~130	√ ~200	Most common in areas of open tundra and grasslands; mountain meadows, muskeg, sedge flats. Den sites are often on hillsides (MacDonald and Cook 2009).
American black bear (*Ursus americanus*)				√ ~3,700	√ A	√ ~400	√ ~750	Usually within forested habitats, prefer semi-open areas with fruit-bearing shrubs and herbs, lush grasses, and succulent forbs (MacDonald and Cook 2009). Black bears considered abundant (A) in GMU 13 (Tobey 2008)
Furbearers								
American beaver (*Castor canadensis*)		√ *11* A ±	√ *9* A ±	√ *307* A ±	√ *63* C ±	√ *7* A ±	√ *91* A ±	Found in lakes, ponds, marshes, rivers and streams over most of mainland Alaska, north to near crest of Brooks Range. Common to abundant in suitable habitat (MacDonald and Cook 2009).

TABLE 5.5-3 Common Terrestrial Mammals that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
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American marten (*Martes americana*)		√ *199* A ±	√ *143* A +	√ *1,188* C ±	√ *333* C ±	√ *102* A ±	√ *54* A ±	Found in most forested regions of Alaska, adapted to variety of forested habitats, optimum habitat mature old-growth spruce with well-established understory, and abundant rodents and other prey (MacDonald and Cook 2009).
American mink (*Neovison vision*)		√ *36* C +	√ *4* C ±	√ *187* C ±	√ *51* C ±	√ *0* C ±	√ *12* C ±	Found throughout much of Alaska south of the Brooks Range, associated with marine and freshwater systems; riparian habitats, lakeshores, marshes, stream banks, lower densities and larger population fluctuations in interior populations (MacDonald and Cook 2009).
Arctic fox (*Vulpes lagopus*)	√ *0* C ±							Occur along arctic coast, adapted to life in cold harsh environment, arctic tundra, rocky beaches, and pack ice. Den in sandy soil along river banks, on hills, common and sometimes abundant; populations fluctuate with food availability (MacDonald and Cook 2009)
Arctic ground squirrel (*Spermophilus parryii*)	√	√	√	√	√	√	√	Widely distributed across Alaska, occur in tundra, meadow, riverbank and lakeshore habitats where well-drained permafrost-free sites provide vantage, vegetation, and soils for burrows. Colonial and locally abundant over much of range, burrows, hibernates. The arctic subspecies (*Spermophilus parryii kennicottii*) occurring north of the Brooks Range is considered a conservation concern (ADF&G 2006).
Canada Lynx (*Lynx canadensis*)		√ *93* C +	√ *2* C ±	√ *154* C ±	√ *73* C ±	√ S ±3	√ *0* S ±	Found primarily in interior forests of Alaska, uncommon to common and periodically abundant, prefer forests with dense understory, populations fluctuate with snowshoe hare (MacDonald and Cook 2009).
Common muskrat (*Ondatra zibethicus*)		√ *200* C +	√ *11* S ±	√ *18* S ±	√ *44* C ±	√ *0* C ±	√ *49* C ±	Found throughout much of Alaska south of the Brooks Range, inhabit fresh, brackish, saltwater marshes, ponds, lakes, rivers, streams, widespread and common, sometime abundant (MacDonald and Cook 2009).
Coyote (*Canis latrans*)		√ *0* S ±	√ *0*	√ *99* C ±	√ *46* C ±	√ *7* C ±	√ *35* C ±	Thrive in diverse habitats; prefer broken and open country in Alaska, not especially abundant, common in Tanana, Matanuska, and Susitna drainages (MacDonald and Cook 2009).

TABLE 5.5-3 Common Terrestrial Mammals that Occur along the Proposed Project ROW

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Ermine (*Mustela erminea*)	√ *0* C +	√ *6* C -	√ *19* C +	√ *135* C ±	√ *68* A ±	√ *9* A ±	√ *6* A ±	Found throughout Alaska, use wide variety of habitats, common and widespread, populations fluctuate with small mammal prey, prefer edge habitats, near meadows, stream banks, lakeshores, beaver ponds, cover of rock talus, shrub thickets, stumps, logs (MacDonald and Cook 2009).
Hoary marmot (*Marmota caligata*)			√	√	√	√	√	Found in mountainous regions south of Yukon river in Alaska, prefer rocky tundra habitats on sides of canyons and valleys in mountains, common in suitable habitat (MacDonald and Cook 2009)
Least weasel (*Mustela nivalis*)	√ C +	√ C -	√ C +	√ C ±	√ A ±	√ A ±	√ A ±	Found throughout Alaska, wide variety of forest and tundra habitats, prefer meadows, marshes, riparian habitat with abundant small mammal prey (MacDonald and Cook 2009).
North American river otter (*Lontra canadensis*)		√ *0* S ±	√ *2* C ±	√ *31* S ±	√ *13* C ±	√ *3* C ±	√ *6* C ±	Occur throughout most of Alaska south of the Brooks Range, semi aquatic, inhabits wide variety of coastal marine and freshwater habitats (MacDonald and Cook 2009).
Northern flying squirrel (*Glaucomys sabrinus*)			√	√	√	√	√	Probably occurs throughout much of forested Alaska, but distribution poorly documented. Occurs in wide variety of boreal forests and coastal rain forest; assumed association with mature and old-growth forests, uses tree cavities, snags for shelter.
Red fox (*Vulpes vulpes*)	√ *2* A +	√ *9* C ±	√ *11* C ±	√ *207* C ±	√ *152* C ±	√ *4* C ±	√ *26* C ±	Occur throughout most of mainland Alaska; live in wide variety of habitats, common south of arctic tundra (MacDonald and Cook 2009). Also inhabits the North Slope area north of the Brooks Range.
Red squirrel (*Tamiasciurus hudsonicus*)	√ *0*	√ *20* A ±	√ *25* A +	√ *172* A ±	√ *40* A ±	√ *0* A ±	√ *20* A ±	Throughout most of forested Alaska, from near crest of the Brooks Range, common within core range, characteristic of coniferous forest but also occur in mixed hardwood forests and occasionally beyond tree line in riparian shrub thickets (MacDonald and Cook 2009), uses cavities, middens for food storage and shelter.
Wolf (*Canis lupus*)	√ ~25 *3* A ±	√ ~470 *9* A ±	√ ~460 *3* A ±	√ ~800 *74* C -	√ ~350 *27* C -	√ ~30 *0* C ±	√ ~80 *4* C ±	Widely distributed in Alaska, populations generally stable, thrive in a wide variety of climates and terrains, found where suitable prey populations exist in Alaska (MacDonald and Cook 2009).

TABLE 5.5-3 Common Terrestrial Mammals that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
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Wolverine (*Gulo gulo*)	√ *1*	√ *1* C ±	√ *1* C ±	√ *10* S ±	√ *27* C ±	√ *2* S ±	√ *0* S ±	Widely distributed throughout Alaska, range great distances and habitat types, reproductive dens usually long, complex snow tunnels with no associated trees or boulders, not abundant (MacDonald and Cook 2009). Annual harvest ~190 across GMUs (ADF&G 2007b).
Woodchuck (*Marmota monax*)			√	√	√	√	√	Restricted to between Tanana and Yukon rivers from Nenana to the Alaska-Yukon border, rare to uncommon within range prefer open, well-drained grassy areas and open deciduous forest with grasses, forbs and shrubs (MacDonald and Cook 2009).
Small Game Animals								
Snowshoe hare (*Lepus americanus*)	√	√	√	√	√	√	√	Found throughout taiga in Alaska; inhabit forests, shrubby woodlands and riparian shrub thickets, generally common and periodically very abundant (MacDonald and Cook 2009).
North American porcupine (*Erethizon dorsatum*)	√	√	√	√	√	√	√	Occur in wide variety of habitats from closed forest to open shrub tundra, common and widespread throughout most of Alaska (MacDonald and Cook 2009).
Unclassified Mammals								
Brown lemming (*Lemmus trimucronatus*)	√	√	√	√	√	√	√	Occurs in variety of arctic, alpine tundra, and taiga habitats, usually associated with wet sedge-grass tundra, spruce bogs, wet meadows; densities vary year to year (MacDonald and Cook 2009).
Cinereus shrew (*Sorex cinereus*)		√	√	√	√	√	√	Common and widespread throughout Alaska; abundance can fluctuate year to year, wide variety of habitats, but may be especially abundant in riparian areas with dense ground cover (MacDonald and Cook 2009).
Collared pika (*Ochotona collaris*)				√	√	√	√	Occur in mountains of east-central and southern Alaska; may be locally common, form colonies in mountainous terrain. Rock slides, talus slopes, and large boulders near meadows and vegetated patches (MacDonald and Cook 2009)
Dusky shrew (*Sorex monticolus*)		√	√	√	√	√	√	Common, sometimes abundant, and widespread throughout Alaska south of the Brooks Range, uses a wide variety of habitats, dense moist or wet understory ground cover (MacDonald and Cook 2009).

TABLE 5.5-3 Common Terrestrial Mammals that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Numbers[a] by Game Management Sub-Unit (North to South)							Habitat Association
	26B MP0-174.8	25A,D MP174.8 -180.7; MP322.2 -329.5	24 MP180.7 -322.2	20A,B,C, D,F MP398.3-562.0	13E	16A MP645.6 -674.8	14A,B MP674.8 -737.0	
Little brown myotis (*Myotis lucifugus*)				√	√	√	√	Most common and widespread bat in Alaska, in numerous habitats but especially forested regions at roosts and maternity colonies. Unknown if overwinter at northern latitudes or if they migrate to hibernacula (MacDonald and Cook 2009).
Northern red-backed vole (Clethrionomys gapperi)	√	√	√	√	√	√	√	Common and widespread throughout mainland Alaska although densities may fluctuate between years. Most abundant in forested, woodland, and shrub habitats (MacDonald and Cook 2009).
Root vole (Microtus oeconomus)	√	√	√	√	√	√	√	Broadly distributed across Alaska; densities fluctuate between years, uses variety of open herbaceous habitats, most abundant in wet sedge and grass-forb meadows and bogs (MacDonald and Cook 2009).

√ = Indicates that the species occurs in the Game Management Unit or Subunit. Square brackets present alternative common names.

[a] Numbers are population estimates for Big Game Animals from management reports. Italic numbers are harvest estimates for Furbearers, followed by abundance (A = abundant, C = common, S = scarce) and population trend (+ = increase, - = decrease, ± = no change) for 2005-2006 as reported by trappers (Blejwas 2007).

[b] Protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 5.8. Marine Mammals are discussed in Section 5.7.

Sources:

Big Game Animals – Caikoski 2008a, Caikoski 2008b, Caikoski 2009a, DuBois 2007a, DuBois 2008a, DuBois 2008b, DuBois 2008c, DuBois 2008d, DuBois 2007b; DuBois 2008e; Gross 2007; Hollis 2007; Kavalok 2008; Kavalok 2005; Kavalok 2007a; Kavalok 2007b; Lenart 2007; Lenart 2008; Lenart 2009a; Lenart 2009b; Peltier 2008a; Peltier 2008b; Peltier 2008c; Seaton 2008a; Seaton 2008b; Seaton 2008c; Stout 2008; Stout 2007; Tobey and Kelleyhouse 2007a; Tobey and Schwanke 2008; Tobey 2008; Tobey and Kelleyhouse 2007b; Young 2007a; Young 2008a; Young 2008b; Young 2008c; Young 2007b.

Furbearers – Blejwas 2007; Caikoski 2009b; DuBois 2006; Kelleyhouse 2006; Parker McNeill 2006; Peltier 2006a; Peltier 2006b; Stephenson 2006; Young 2006.

TABLE 5.5-4 Common Waterbirds and Game Birds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Waterbirds						
Waterfowl - Dark Geese						
Brant (*Branta bernicla*)	√ 10,221				1,700	Nests in lowland, coastal tundra; during migration uses saltwater bays and estuaries.
Canada goose (*Branta canadensis*)	√ 21,289	√ 4,455	√ 564	√ 605	5,422	Various subspecies use wide variety of habitats from tundra to south coastal wetlands; usually associated with wetland, lakes, and ponds. Nest throughout Alaska, large aggregations during migrations. Cackling goose (*Branta hutchinsii*), previously considered a subspecies of the Canada goose, nest on ACP.
Greater white-fronted goose (*Anser albifrons*)	√ 222,891	√ 0	√ 0	√ 0	339	Nests in arctic and Yukon Flats; migrates through Kenai-Susitna. Subspecies – tule white-fronted goose (*Anser albifrons elgasi*) nests in Kenai-Susitna.
Waterfowl - White Geese						
Snow goose (*Chen caerulescens*)	√ 27,926	√ 0	√ 0	√ 0	339	Nests in arctic, often in colonies; migrates through central Alaska. A few Ross's geese (*Chen rossii*), a similar small white goose, also nest in arctic Alaska.
Waterfowl - Swans						
Tundra swan (*Cygnus columbianus*)	√ 14,174	√	√	√		Nests on tundra, during migration use saltwater, wetlands, lakes and rivers. Tundra swans breed on Arctic Coastal Plain and western Alaska. Occur throughout Alaska during spring and fall migrations. No sport hunting of tundra swans allowed in GMUs crossed by the proposed Project; subsistence harvest in western Alaska.
Trumpeter swan (*Cygnus buccinator*)		√ 810	√ 9,455	√ 605		Forest wetlands, lakes, marshes, rivers with dense vegetation. Trumpeter swans breed in central and southcoastal Alaska. No sport hunting of trumpeter swans allowed in Alaska.
Waterfowl - Ducks						
Mallard (*Anas platyrhynchos*)	√ 325	√ 100,246	√ 79,481	√ 7,461	22,126	Marshes, sloughs, lakes, rivers throughout Alaska; less common in arctic and brackish waters.
American wigeon (*Anas americana*)	√ 630	√ 239,477	√ 105,178	√ 8,833	9,901	Breeds in freshwater marshes, sloughs, ponds, marshy edges of lakes; migration and winter in shallow coastal bays; less common in arctic

TABLE 5.5-4 Common Waterbirds and Game Birds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Green-winged teal *(Anas crecca)*	√ 246	√ 124,675	√ 80,081	√ 5,861	9,396	Breeds in freshwater ponds, marshes, and shallows of lakes surrounded by woods; migration uses brackish intertidal areas near mouths of streams; less common in arctic.
Northern shoveler *(Anas clypeata)*	√ 848	√ 75,074	√ 42,012	√ 1,843	1,515	Breeds in shallow, often muddy, freshwater marshes, sloughs, and lakes; for migration uses coastal saltwater mud flats and shallow freshwater areas.
Northern pintail *(Anas acuta)*	√ 56,073	√ 93,523	√ 41,734	√ 3,037	7,779	Most widely distributed and abundant dabbling duck in Alaska; breeds in marshy, low areas with shallow freshwater lakes, brackish estuaries and sluggish streams with marshy borders; for migration uses salt and brackish waters along coast
Canvasback (*Aythya valisineria*)		√ 24,276	√ 7,704		202	Breeds in marshes, sloughs, deep-water lakes with vegetated shorelines; migration uses saltwater bays, large lakes, and rivers.
Lesser scaup (*Aythya affinis*) Greater scaup (*Aythya marila*)	√ 17,693	√ 166,339	√ 46,162	√ 6,507	303	Greater scaup breeds on tundra or low forest next to tundra, nests in dense vegetation next to freshwater lakes and ponds. Lesser scaup breeds on interior lakes and ponds, nests in dry grassy areas near lakeshores. Both winter in coastal saltwater.
Common goldeneye (*Bucephala clangula*) Barrow's goldeneye (*Buchephala islandica*)		√ 3,899	√ 11,191	√ 3,574	4,647	Nests in cavities, lakes, and ponds surrounded by trees. Barrow's goldeneye may also use rocks or cliffs. Winters in inshore marine waters, lakes and rivers with open water.
Bufflehead (*Bucephala albeola*)		√ 20,088	√ 18,084	√ 1,637	1,010	Nests in cavities, lakes, and ponds surrounded by trees. Winters in inshore marine waters, lakes and rivers with open water.
Waterfowl - Sea Ducks						
Common merganser (*Mergus merganser*) Red-breasted merganser (*Mergus serrator*)	√ 1,487	√ 1,372	√ 2,684	√ 2,375	2,159	Breeds in forested areas where associated with rivers and clear freshwater lakes. Common merganser nests in hollow trees, cliffs and on ground under cover. Red-breasted merganser nests on ground under cover or in driftwood – often near coast. Winter inshore marine or freshwaters.
Common eider (*Somateria mollissima*)	√ ~2,000			√		Nests coastal arctic, uses barrier islands, migration and winter uses inshore marine waters.
King eider (*Somateria spectabilis*)	√ 22,375			√		Nests on ponds and lakes on coastal arctic tundra, migration, and winter use inshore marine waters.

TABLE 5.5-4 Common Waterbirds and Game Birds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (North to South)					Habitat Association
	Arctic Coastal Plain	Yukon Flats	Tanana - Kusko-kwim	Kenai - Susitna	Alaska Harvest (2008)	
Harlequin duck (*Histrionicus histrionicus*)		√	√	√		Nests along cold, rapidly flowing streams, often surrounded by forest, on ground close to water protected by dense vegetation; not visible during standard breeding pair surveys; in winter uses inshore marine waters, rocky shorelines.
Long-tailed duck (*Clanula hyemalis*)	√ 48,812		√ 2,524	√ 219		Breeds on tundra near lakes or ponds on ground often under low shrubs; winters inshore marine waters.
Black scoter (*Melanitta nigra*) Surf scoter (Melanitta perspicillata) White-winged scoter (*Melanitta fusca*)	√ 2,872	√ 11,372	√ 36,904	√ 2,554	6,477	Black scoter – nests on lakes, ponds, or rivers in tundra and woodlands on ground. Surf scoter – not well known, probably near freshwater in shrubby cover or woodland. White-winged scoter – interior lakes and streams on ground under shrubs and trees. All winter on inshore marine waters.
Other Waterbirds						
Pacific loon (*Gavia pacifica*)	√ 39,188	√ 4,300	√ 1,100	√ 100		Breeds on lakes in tundra or coniferous forest habitats; nests on shoreline points or small islands; migration and winter uses inshore and offshore marine waters.
Common loon (*Gavia immer*)	√	√ 1,100	√ 1,600	√ 700		Breeds on lakes in coniferous forests; nest mound of vegetation near water often on small islands; winter uses inshore marine waters.
Red-throated loon (*Gavia stellata*)	√ 3,080	√ 0	√ 300	√ 0		Breeds on ponds and small lakes, nest on shoreline or islands; migration and winter uses inshore marine waters.
Wilson's Snipe (*Gallinago delicata*)	√	√	√	√	1,100	Breeds on muskeg, freshwater marshes, on ground usually in grass; migration and winter uses grass meadows on tidal flats and freshwater marshes.
Sandhill crane (*Grus canadensis*)	√ 14,174	√ 1,215	√ 916	√ 110	1,700	Breeds lowland tundra marshes, nest on ground; migration, tidal flats, muskegs – during migration roosts at night on exposed and shallow submerged river bars in large rivers.
Upland Game Birds						
Spruce grouse (*Falcipennis canadensis*)		√	√	√		Inhabits white spruce and paper birch woodlands, black spruce bogs. Males display in May; nests on the ground, at base of spruce tree or beneath log, hatch mid-June. In winter, loaf and feed on spruce trees and needles.

TABLE 5.5-4 Common Waterbirds and Game Birds[a] that Occur along the Proposed Project ROW

	Occurrence and Estimate Breeding Abundance (North to South)					
Common and Scientific Names	**Arctic Coastal Plain**	**Yukon Flats**	**Tanana - Kusko-kwim**	**Kenai - Susitna**	**Alaska Harvest (2008)**	**Habitat Association**
Ruffed grouse (*Bonasa umbellus*)		√				Most abundant in dense stands of aspen or birch, established after fire or timber harvest. Males establish breeding territories previous fall, display during spring. Nest beside a stump, under a fallen tree, beneath overhanging shrubs along forest edges or openings.
Sharp-tailed grouse (*Tympanuchus phasianellus*)		√				Inhabits forested habitats, recent burn areas, and open grass-shrub muskegs. Males display in late April through early May, nest on ground.
Willow ptarmigan (*Lagopus lagopus*)	√	√	√	√		Inhabits willow-lined waterways, tall bushes important habitat feature; wetter places with luxuriant vegetation. Males establish breeding territories by late April or early May, nests on ground under shrub at edge of opening. Flocks form in September; move southward to wintering areas as much as 100 miles away during October and November, move northward in February with peak movement in April.
Rock ptarmigan (*Lagupus mutus*)	√	√	√	√		Inhabits slopes and high valleys with shin-high shrubs with low herbs and grasses. Nest under low shrubs or in open, nest sites not re-used, hatch in June. Flocks form in September and move to low-elevation wintering areas.
White-tailed ptarmigan (*Lagopus leucurus*)				√		Inhabits areas above timberline in mountains most of year; boulder fields, snowfields, rockslides; move lower during late fall winter on slope in alder, willow, birch. Males establish territories by late April; nest on narrow, mossy ledges or against boulders.

√ = Indicates that the species occurs in the survey area or Subunit.

[a] Numbers are population estimates from survey area reports.

[b] Protected animals including federal and state listed endangered, threatened or candidate species and species identified as conservation concerns or priority are discussed in Section 5.8. Marine Mammals are discussed in Section 5.7.

Sources: Armstrong 1990, Larned et al. 2010, Mallek and Groves 2009.

Terrestrial Mammals

Moose and caribou are the primary large terrestrial mammals that could occur along the proposed Project ROW. Harvest record information is included by big game species to indicate resource use in the area. Average annual reported harvests between 2001 and 2006 were 3,726 moose and 3,184 caribou for the seven GMUs (ADF&G 2007a). Dall sheep are the next most harvested ungulate with an average annual harvest of 556 sheep; followed by American bison with an average annual harvest of 98 bison. Few muskoxen are harvested; average annual harvest is six muskoxen. The annual harvest of bears averages 745 for black bears and 379 for brown bears; and annual harvest of wolves averages 625 wolves (ADF&G 2007a).

Moose

Moose populations occur throughout Alaska, although they are uncommon in coastal portions of the Arctic Coastal Plain north of the Brooks Range (Table 5.5-2). Sensitive periods include calving during mid-May to early June, rutting during late September and early October, and winter foraging January through May. In GMU 26 (MP 0.0 – 174.8) moose are generally associated with narrow strips of shrub communities along drainages except during calving and summer when some dispersal occurs, and they may move extensively within and between North Slope drainages (Lenart 2008).

Moose are distributed throughout GMU 25 (MP 174.8 – 180.7; MP 322.2 – 329.5) in low densities, with higher densities in riparian habitats in late winter and in early winter along the upper Sheenjek and Coleen rivers, reflecting some movement between higher elevation early winter range and lower elevation late winter and summer ranges (Caikoski 2008b). In GMU 24A (MP 180.7 – 322.2) moose use broad riparian habitats year-round with short seasonal migrations; in the northern habitats, moose are found at tree line areas during early winter and move to river bottoms during late winter and summer (Stout 2008). Moose densities in GMU 20C and 20F are generally low due to a combination of limited habitat; although there are some riparian areas, subalpine hills, and burn areas with habitat suitable for moose (Seaton 2008a). Moose are distributed throughout GMU 20B (MP 398.3 – 476.0) with both non-migratory and migratory subpopulations. Migratory populations move from the Chena and Salcha river drainages from February to April to summer range on the Tanana Flats in GMU 20A (MP 476.0 – 502.1; MP 535.2 – 562.0), where most remain during the summer and return to the foothills from August through October (Young 2008b). Moose distribution in GMU 20A (MP 476.0 – 502.1; MP 535.2 – 562.0) varies widely, with both non-migratory and migratory populations. Migratory populations travel from the surrounding foothills in the Alaska Range's Chena and Salcha river drainages to summer range on the Tanana Flats where they remain through June, returning to the foothills from July through October (Young 2008b). In GMU 13E (MP 562.0 – 645.6) moose concentrate in subalpine habitats during rutting and postrutting; with winter distributions dependent on snow depth and wolf distribution; with moose movements occurring earlier with lower densities in riparian habitats (Tobey and Schwanke 2008). In GMU 16A (MP 645.6 – 674.8) moose abundance fluctuates with winter severity and has likely declined due to predation with additional mortality from malnutrition and highway accidents (Kavalok 2008). In GMU 14B (MP 674.8 – 707.0) moose make annual movements that cross management unit boundaries into GMU 16A (MP 645.6 – 674.8) and 14A (MP 707.0 – 737.0); movements make moose in these units vulnerable to collision mortality from trains and vehicles (Peltier 2008a).

Caribou

Caribou from seven herds, defined by calving areas, range through the proposed Project area (Table 5.5-2). Sensitive periods include calving in May to June, summer insect season in late June through mid-August, rut in September to October, and winter foraging from November through March. Herd ranges often overlap during summer and winter. The proposed Project would construct the segments of the pipeline in the Arctic region during the winter period only, thus reducing impacts to the majority of the caribou herds because few caribou are present in the winter in relation to other times of the year. Construction would occur during one winter season and mitigation to reduce disturbance to a few caribou would be determined from collaborations with ADFG and AGDC (see Section 5.23, Mitigation). The pipeline would be buried except for the first 6 miles from the GCF, and would be placed on Vertical Support Members (VSMs) at the appropriate height for caribou to pass underneath the pipeline.

The Central Arctic caribou herd calves between the Colville and Canning rivers in GMU 26B; summer range extends from just west of the Colville River delta east and inland within 30 miles to the Katakturuk River; winter range includes northern and southern foothills and mountains of the Brooks Range (Lenart 2009a). Caribou migrate through Anaktuvuk Pass twice a year (spring and fall) but the numbers and specific time varies from year to year (Section 5.14.2.2).

The Porcupine caribou herd migrates between Alaska and Yukon and Northwest Territories in Canada; calving distributions vary with snow cover. In 2007, calving was concentrated near the Malcolm and Firth rivers, Yukon; summer range in Alaska was concentrated between the Jago and Aichilik rivers south into the Brooks Range; fall distribution in Alaska includes the Richardson Mountains into the upper Sheenjek and Chandalar river drainages; winter distributions in Alaska were concentrated around Arctic Village between the Sheenjek and East Fork Chandalar rivers in 2007-2008 (Caikoski 2009a).

The Ray Mountains caribou herd calves on the southern slopes of the Ray Mountains; summers in alpine areas of the Spooky Valley area around Mount Henry Eakins and south of the upper Tozitna River; and winters on the northern slopes of the Ray Mountains (Hollis 2009).

The Nelchina caribou herd calves in the eastern Talkeetna Mountains from the Little Nelchina River north to Fog Lakes where they remain after calving into early summer. The fall range extends from the Denali Highway across the Alphabet Hills and the Lake

Louise flats as far east as the Gulkana River, and winter range extends from Cantwell east across GMU 13A and 13B and northeast into GMU 11, 12, and 20E (Tobey and Schwanke 2009).

Dall Sheep

Dall sheep occur throughout the proposed Project area ROW in alpine and subalpine habitats between Galbraith Lake and Poss Mountain in the Middle Fork Koyukuk River Valley (Craig and Leonard 2009). Sensitive periods include lambing in mid-May to late June, which is concurrent with mineral lick site use. Rams visit ewe wintering areas during the rut (Summerfield 1974). Dall sheep move from wintering areas to lambing areas in May to mid-June and to rutting areas from late September to late October. Dall sheep move to winter areas in late November through December (Seaton 2008b). Dall sheep also occur in the Alaska Range, Talkeetna Mountains, and the Chulitna-Watana Hills.

Muskoxen

Muskoxen occur on the Arctic Coastal Plain and Brooks Range foothills in GMU 26B. They are found primarily near Beechey Point, Deadhorse, and along the Sagavanirktok and Ivishak rivers, with a few animals reported on the south side of the Brooks Range (Lenart 2009b). Muskoxen aggregate in larger groups 6 to 60 during the winter and remain in one location for long periods of time, splitting into smaller groups of 2 to 20 animals during the summer and moving more frequently (Lenart 2009b). Sensitive periods for muskoxen include calving in April to June and in winter from November to February.

Bears

Sensitive periods for brown (grizzly) bears and black bears are the denning period; which begins in late September and extends to October with emergence in April and May. Brown bear densities are generally highest in the foothills and mountains of the Brooks Range and lowest on the Arctic Coastal Plain where riparian habitats are used extensively (Lenart 2009c). Brown bear densities are higher in the mountainous portion of GMU 20A and 20C for the Central and Lower Tanana Valley and Middle Yukon river drainages (Young 2009). Brown bear populations in the upper Cook Inlet have been influenced by agricultural settlement, development, and urbanization; population estimates are confounded by forest cover (Peltier 2009).

Black bears live throughout Interior and Southcentral Alaska. Distributions shift seasonally with bears using moist lowlands with early growing vegetation in spring, and berries in open meadow or alpine areas in fall (Seaton 2008c). Seasonal availability of salmon affects distributions of both brown and black bears (Tobey 2008; Seaton 2008c).

Small Terrestrial Mammals

The small terrestrial mammals that are hunted or trapped in the proposed Project area are listed in Table 5.5-2 (Blejwas 2007). Fur harvest for the GMUs crossed by the proposed Project was dominated by American marten, American beaver, red fox, Canadian lynx, common muskrat, and American mink (Table 5.5-2). Harvest rates for small terrestrial mammals may increase with increased hunter access to areas from proposed Project development. Small terrestrial mammals use a wide variety of habitats, including forests, river and stream banks, ponds, and marshes. American beavers, American mink, North American river otter, and weasels are associated with riparian and wetland areas. Most small terrestrial mammals are associated with some type of den or cover for giving birth and for shelter during winter months.

The proposed Project crosses many different habitats that are home to a wide variety of animals, most of which are considered game. Small terrestrial mammals such as Arctic ground squirrels, red squirrels, lemmings, voles, and shrews provide important prey for bears, wolves, wolverines, coyotes, foxes, American marten, ermine, raptors and owls.

Waterbirds and Upland Game Birds

The proposed Project area is administered by the Pacific Flyway Council. All ducks, geese, swans, waterbirds, shorebirds and sandhill cranes are considered migratory. Waterfowl from the Pacific, Central, and Mississippi Flyways are known to breed or migrate within the proposed Project area. Most bird species migrate through the proposed Project area and use it for staging or stop over uses during the spring and fall migration periods. Some birds may winter in the Cook Inlet near the southern end of the proposed Project. Rare birds such as the Kittlets Murrelet may be found in small numbers in the Cook Inlet, but would not likely be affected by proposed vessel traffic because they inhabit near shore areas away from shipping lanes and ports. The Port of Anchorage is not proposed for use to receive materials for the construction of the proposed Project.

All migratory birds are protected by the MBTA (16 USC 703–712; 40 Stat. 755 as amended) which prohibits the take of any migratory bird without authorization from USFWS. Hunting seasons are set and regulated by USFWS and the ADF&G. Waterfowl are harvested primarily in fall; however, subsistence hunting may occur year-round. Non-migratory birds such as upland game birds (grouse and ptarmigan) and non-native birds such as European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), and house sparrow (*Passer domesticus*) are not protected by the MBTA. The proposed Project ROW would be located near three Important Bird Areas (IBAs) which provide important habitat for breeding, migrating, and staging waterbirds (Figure 5.5-2). These areas include:

- The Kahiltna Flats – Petersville Road, Globally Important Bird Area: Kahiltna floodplain contains one of the largest concentrations of trumpeter swan nesting sites in the upper Cook Inlet wetlands at the base of the Kahiltna Glacier. This area is used by molting post-breeders, and greater white-fronted geese young-of-the-year;

- The Susitna Flats – Globally Important Bird Area: Spring and fall migrant ducks, geese, and swans exceed 100,000 birds in spring with peak densities in early May. This area is used by lesser sandhill cranes and swans for migration staging (Audubon Alaska 2010); and
- The Minto Flats State Game Refuge – One of the highest quality waterfowl habitats in Alaska which sustains one of the largest trumpeter swan breeding populations in North America. Minto Flats is also an important spring and fall waterfowl staging area, particularly for geese and swans.

Table 5.3-3 illustrates the common bird species, breeding abundance, harvest data, and habitat association within the proposed Project area.

Landbirds

Landbird is an informal name that represents a large and diverse group of birds that share molecular characters. Landbirds include the passerines (primarily), owls, falcons, hawks, and woodpeckers. The proposed Project area crosses through the Arctic and Northern Forest Avifaunal Biomes (Rich et al. 2004). Landbirds breeding in tundra and boreal forest habitats include short-distance migrants, long-distance migrants, and resident species.

The number of breeding landbirds increases from north to south with 2 to 31 species inhabiting the Arctic tundra, 32 to 61 landbird species in the Brooks Range, and 62 to 91 landbird species in northern forests (Rich et al. 2004). Most landbirds breeding in Arctic Alaska are short-distance migrants, and many winter in the north Pacific coastal states and across the northern United States (Rich et al. 2004). Short-distance and long-distance migrants breed in central Alaska, and may winter in the north Pacific coastal states, across the southern United States, or into Central and South America (Rich et al. 2004). The two IBAs support landbirds during breeding and migration staging (see Figure 5.5-2).

- The Alaska Range Foothills – State Important Bird Area (IBA): contains one of the highest reported densities of nesting golden eagles in North America, substantial numbers of nesting gyrfalcons and other subalpine nesting birds; and
- The Kahiltna Flats – Petersville Road, Globally IBA: supports significant multi-species assemblages and concentrations including 10 landbirds of conservation concern (Audubon Alaska 2010). These landbirds include the Gray-cheeked Thrush; Golden-crowned Sparrow; Varied Thrush; Bohemian Waxwing; Arctic Warbler; White-winged Crossbill, Blackpoll Warbler, and Olive-sided Flycatcher.

Common birds, survey areas, estimated breeding abundance, and associated habitats are described in Table 5.5-5. Estimated breeding abundance was obtained from Breeding Bird Survey data (Sauer et al. 2008a). Although quantitative data on bird distribution and abundance along the proposed Project is limited, breeding-bird surveys represent the best available data for the entire proposed Project area (Sauer et al. 2008b).

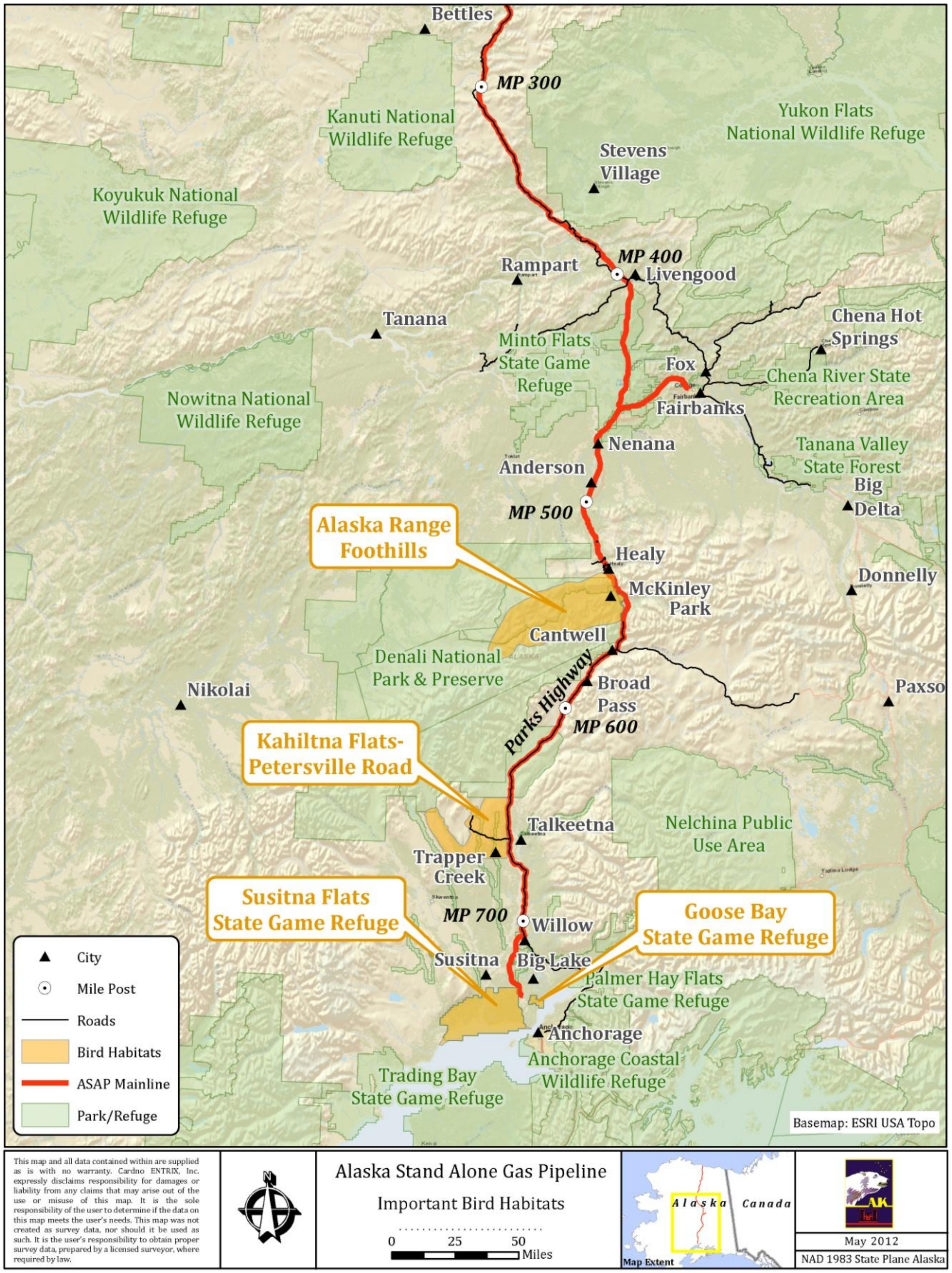

FIGURE 5.5-2 Important Bird Areas and Wildlife Refuges along the Proposed Project ROW (Audubon Alaska 2008)

TABLE 5.5-5 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Shorebirds				
American golden plover *(Pluvialis dominica)*	√	√	√	Breeds on drier tundra in moss; migration uses tidal flats.
Semipalmated plover (*Charadrius semipalmatus*)	√	√	√	Breeds on gravelly or sandy beaches of lakes, ponds, rivers, glacial moraines on ground in sand, gravel or moss; migration uses lakes, ponds, rivers, glacial moraines, tidal flats.
Greater yellowlegs (*Tringa melanoleuca*)		√	√ 1.0	Breeds in muskegs, freshwater marshes, nests on ground in moss; uses tidal flats, lakes ponds during migration.
Lesser yellowlegs *(Tringa flavipes)*	√ 1.2	√ 0.6	√ 4.0	Breeds in muskegs, freshwater marshes; uses tidal flats, lakes, ponds during migration.
Solitary sandpiper *(Tringa solitaria)*		√ 0.1	√ 0.4	Breeds in muskegs, freshwater marshes, lakes ponds; nests in deserted nests of other birds; migration uses muddy shorelines of ponds, streams in wooded areas.
Semipalmated sandpiper *(Clicris pusilla)*	√			Breeds in wet tundra, nests on ground; during migration uses tidal flats, beaches, lake shores.
Spotted sandpiper (*Actitis macularia*)	√ 0.1	√ 0.1	√ 0.5	Found on shores of rivers, streams, lakes, and saltwater beaches; nests near water in gravel or grass.
Upland sandpiper (*Bartramia longicauda*)		√	√ 0.2	Breeds in open grassy fields, sparsely vegetated uplands, not usually associated with water, perches on small trees.
Red-necked phalarope *(Phalaropus lobatus)*	√	√	√	Breeds in wet tundra, freshwater marshes, ponds, lakes; nests on ground in wet grassy areas; migration uses inshore and offshore marine waters, tidal ponds, sloughs, ponds, lakes.
Seabirds				
Herring gull (*Larus argentatus*)		√	√ 1.7	Breeds in lakes, rivers, islands, tidal flats and beaches; nests on ground; migration and winter uses lakes, rivers, tidal flats, beaches, garbage dumps, inshore marine water – often more inland than other gulls.
Glaucous-winged gull (*Larus glaucescens*)		√	√ 3.2	Nests in colonies on flat, low islands, cliff ledges, and rocky beaches; uses tidal flats, beaches, inshore marine waters; for migration and winter uses various habitats often associated with salmon streams.

TABLE 5.5-5 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Glaucous gull (*Larus hyperboreus*)	√			Nests in colonies on cliff ledges on ground on tundra or on barrier islands; for migration and winter uses tidal flats, beaches, inshore marine waters.
Arctic tern (*Sterna paradisaea*)	√	√	√	Nests in colonies or scattered pairs on sand, gravel, moss; uses tidal flats, beaches, glacial moraines, rivers, lakes, marshes; migration uses inshore and offshore marine waters, tidal flats, beaches, rivers, lakes.
Raptors				
Osprey (*Pandion haliaetus*)	√ 0.1	√	√ 0.1	Nests near water in trees or on cliffs; forages on fish.
Bald eagle (*Haliaeetus leucocephalus*)	√ 0.1	√	√ 0.2	Nests in trees or on cliffs old-growth timber along coast and larger mainland rivers; uses coniferous forests, deciduous woodlands, rivers, streams, beaches, tidal flats, rocky shores.
Northern harrier *(Circus cyaneus)*	√ 0.1	√ 0.1	√ 0.1	Uses open country, especially tidal marshes, freshwater marshes; open mountain ridges in Interior; nests on ground in wet marshy areas.
Sharp-shinned hawk (*Accipiter striatus*)		√ 0.1	√	Uses coastal and interior coniferous forests, shrubs, mixed woodlands, forest edges; nests in conifers.
Northern goshawk (*Accipiter gentilis*)	√ 0.1	√	√ 0.1	Uses coastal and boreal forests, forest edges; nests in heavy timber usually in conifers.
Red-tailed hawk (*Buteo jamaicensis*)		√ 0.1	√ 0.1	Uses coniferous forests and deciduous woodlands with open areas for hunting; nests in trees or on cliffs.
Rough-legged hawk *(Buteo lagopus)*	√			Uses upland tundra with cliffs and rocky outcrops; nests on cliffs or trees.
American kestral (*Falco sparverius*)	√ 0.2	√ 0.1	√ 0.1	Uses forest edges and openings; nests in tree cavities.
Great-horned owl *(Bubo virginianus*)	√ 0.1	√ 0.1	√ 0.1	Inhabits coniferous and deciduous forests, nests in abandoned hawk nests or cliff crevices.
Northern hawk owl *(Surnia ulula*)		√	√	Inhabits open coniferous and deciduous forests, nests in tree cavities on tops of tree stubs, or occasionally on cliffs or tree limb crevice.
Songbirds and Other Birds				
Northern flicker *(Colaptes* spp.)	√ 0.2	√ 0.1	√ 0.4	Nests in holes in trees or stumps; most common in mixed forests, shrub habitats, infrequently observed.

TABLE 5.5-5 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route)			Habitat Association
	Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	
Alder flycatcher (*Empidonax alnorum*)	√ 1.6	√ 5.5	√ 57.9	Inhabits broadleaf forests and shrubs; alder and willow thickets; nests in shrubs.
Gray jay (*Perisoreus canadensis*)	√ 2.0	√ 5.2	√ 3.3	Widely distributed throughout central Alaska; associated with closed and open needleleaf and mixed forests.
Black-billed magpie *(Pica hudsonia)*		√	√ 4.1	Inhabits open broadleaf forest and shrub habitats; nests in tall bushes.
Common raven (*Corvus corax*)	√ 1.6	√ 1.1	√ 1.3	Inhabits marine shores to mountain ridges and glaciers; mixed forests and shrubs; nests in trees or on cliffs.
Black-capped chickadee *(Poecile atricapillus)*	√ 0.1	√ 2.1	√ 5.2	Inhabits broadleaf and mixed forests; nests in tree cavities.
Boreal chickadee (*Poecile hudsonicus*)	√ 1.2	√ 0.3	√ 1.0	Inhabits coniferous and mixed forests; nests in tree cavities.
Ruby-crowned kinglet (*Regulus calendula*)	√ 2.4	√ 6.7	√ 10.9	Coniferous forests and mixed woodlands; nests in conifers; widely distributed, uses more open woodland habitats.
Swainson's thrush (*Catharus ustulatus*)	√ 3.5	√ 37.1	√ 41.2	Mixed woodlands and shrub habitats; nests low in trees or bushes close to trunks.
American robin (*Turdus migratorius*)	√ 10.0	√ 14.7	√ 40.9	Wide variety of habitats primarily mixed forests, and shrubs; nests in crotches of trees
Varied thrush (*Ixoreus naevius*)	√ 2.9	√ 5.8	√ 11.2	Widespread in shady, damp forested habitats; usually nests in conifers.
Orange-crowned warbler (*Vermivora peregrina*)	√ 6.3	√ 17.8	√ 19.0	Deciduous forests, shrub thickets, coniferous forest edges; nests on ground or in low shrubs.
Yellow-rumped warbler (*Dendroica coronata*)	√ 9.5	√ 19.1	√ 42.1	Mixed forests and woodlands, shrub thickets; nests in conifers.
Savannah sparrow (*Passerculus sandwichensis*)	√ 48.6	√ 4.1	√ 14.9	Widespread in Alaska; open habitats – herbaceous, low shrubs; nests on ground usually in open grassy areas.
Fox sparrow (*Passerella iliaca*)	√ 2.7	√ 3.9	√ 14.7	Widespread in Alaska; tall shrubs, forest edges; nests on ground under shrubs or low in trees or shrubs.
White-crowned sparrow (*Zonotrichia leucophrys*)	√ 27.6	√ 35.0	√ 45.9	Shrubs, shrub tundra; forest edges; nests on ground in grass clumps or low shrubs.

TABLE 5.5-5 Common Shorebirds, Seabirds, and Landbirds[a] that Occur along the Proposed Project ROW

Common and Scientific Names	Occurrence and Estimate Breeding Abundance (Average Birds per Route) Arctic 4 Survey Routes (MP 0-256.3)	Intermountain Boreal 3 Survey Routes (MP256.3-519.3)	Alaska Range Transition 9 Survey Routes (MP519.3-736.4)	Habitat Association
Dark-eyed Junco (*Junco hyemalis*)	√ 11.6	√ 45.5	√ 37.5	Breeds coniferous forests and forest edges, clearings, muskeg; nests on ground.
Lapland longspur (*Calcarius lapponicus*)	√	√	√	Common and widespread on tundra; herbaceous and dwarf shrub habitats, nests on ground.
Pine grosbeak (*Pinicola enucleator*)	√ 0.3	√ 0.1	√ 0.1	Forested habitats; nests in conifers.
Redpolls (*Carduelis* spp.)	√	√	√	Tundra shrub thickets, mixed woodlands, open fields, grasslands; nests on ground or lower branches of shrubs.
White-winged crossbill (*Loxia leucoptera*)	√ 5.4	√ 2.2	√ 4.8	Coniferous forests, nests in conifers.

√ = Indicates that the species occurs in the level 2 ecoregion.

[a] Numbers represent the sum of birds per survey route divided by the number of survey routes.

[b] Protected animals including federal and state listed endangered, threatened or candidate species are discussed in Section 5.8. Marine Mammals are discussed in Section 5.7.

Sources: Armstrong 1990, Cotter and Andres 2000, Sauer et al. 2008a.

5.5.1.2 Bureau of Land Management Sensitive Species

Bureau of Land Management (BLM) has the responsibility for the designation and protection of sensitive species on BLM (public) managed lands. Sensitive species require special management considerations to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Alaska evaluates potential project impacts on BLM Alaska-sensitive animals and plants. Alaska-sensitive animals and plants are determined in coordination with recommendations by the Alaska Natural Heritage Program, ADFG, and U.S. Forest Service. BLM also evaluates both federal candidate species and federal delisted species within five years of delisting. BLM sensitive fish and aquatic invertebrates and BLM sensitive plants are discussed in the Section 5.6, Fish and Section 5.3, Terrestrial Vegetation, respectively. The proposed Project would cross about 230 miles of BLM managed lands between MP 123.3 and MP 361 along the Parks Highway route. BLM sensitive animals (BLM 2010) that may occur within the proposed Project area include 2 species of terrestrial mammals and 8 species of birds (Table 5.5-6).

5.5.2 Environmental Consequences

The proposed Project would cross habitats used by a wide variety of wildlife described in Tables 5.5-2 through 5.5-5. Construction of the proposed ROW (including Temporary Extra Workspaces [TEWS]) would result in the loss or alteration of about 9,934 acres as presented in Section 5.3, Terrestrial Vegetation (Table 5.3-3). The proposed Project area would be a narrow piece of land that would be primarily associated with existing ROWs. The amount of habitat loss or disturbance proposed for the proposed Project would be minimal compared to the vast amount of surrounding available habitat for wildlife.

The Fairbanks Lateral would primarily cross boreal and riparian forests. In addition, 40 temporary access roads (approximately 252 miles) and 60 permanent access roads (approximately 34 miles) would be used; the majority (over 90 percent) would be new road corridors. Areas altered by construction of temporary access roads would be rehabilitated and revegetated. Mitigation measures proposed to reduce impacts to wildlife are described in Section 5.23, Mitigation.

The proposed Project could affect wildlife resources through:

- Habitat loss, alteration, and fragmentation;
- Direct mortality during construction and operation;
- A potential increase in wildlife mortality from hunting due to an increase in access to previously inaccessible areas;
- Indirect mortality from stress caused by disturbance from feeding areas, due to construction and operations noise from low-level helicopter or airplane monitoring over flights;

- Reduced survival and reproduction due to a decrease in vegetative cover for optimal nesting, feeding and rearing sites; and
- Altered survival, mortality, or reproduction due to exposure to equipment fuel or lubricants spilled during construction or maintenance.

Fragmentation is the splitting of large continuous blocks of habitat into numerous smaller areas that results in both a smaller total area of habitat, and in isolation of the habitat within a matrix of unlike habitat (Wilcove et al. 1986). Habitat fragmentation includes a reduction in total habitat area and reorganization of areas into isolated patches. Since the proposed Project would be collocated with existing ROWs, and the pipeline would be buried, additional habitat fragmentation would be minimal. Areas proposed that are not collocated with existing ROWs (south of Willow and Minto Flats) would receive some fragmentation. Other conservation measures may be developed in conjunction with USFWS appropriate to protect Bald and Golden Eagles and their nests.

Habitat loss generally has large negative effects on biodiversity, while fragmentation generally has a much weaker effect that may affect wildlife species either positively or negatively (Fahrig 2003). For instance, habitat fragmentation would not be expected to affect small mammals, coyote, moose, or snowshoe hares. Although wolves often avoid human development, they may be attracted to roads with little traffic if increased prey or carcasses occur there. Wolverines prefer large areas of undisturbed wilderness and would thus be negatively affected by habitat fragmentation. The effects of habitat fragmentation on nesting birds depend on original habitat structure, landscape context, predator communities, susceptibility to nest parasitism, and many other recognized or unrecognized variables (Tewksbury et al. 1998).

New vegetative growth within the ROW can provide forage for moose and other grazers if invasive species do not take over the area. Impacts to wildlife from habitat loss, alteration and fragmentation would be minimized by co-locating the proposed Project along existing ROWs. The proposed Project would follow the route of the Trans Alaska Pipeline System (TAPS), the Parks Highway, other transportation corridors (including railroads), or other utility or transportation ROWs along the majority of its 737 mile route.

TABLE 5.5-6 Evaluation of BLM Sensitive Species that Potentially Occur Along the Proposed Project ROW

Common and Scientific Names	Group	Status	Occurrence and Habitat	Potential Impacts
Mammals				
Alaska tiny shrew *(Sorex yukonicus)*	Mammal – Shrew	BLM-SS	Occurs throughout Alaska, associated with wide range of forested and non-forested habitats; usually with riparian scrub habitats.	Construction mortality, habitat loss and alteration.
Osgood's arctic ground squirrel *(Spermophilus parryii osgoodi)*	Mammal – Squirrel	BLM-SS	Central Alaska, in lowland areas of Yukon Flats.	Construction mortality, habitat loss and alteration.
Birds				
Blackpoll warbler (*Dendroica striata*)	Bird – Passerine	BLM-SS	Breeds throughout central and southcentral Alaska; associated with wet coniferous and mixed forests; uses fens, bogs, muskegs, beaver ponds and other swampy forest openings along lakes and streams.	Nesting habitat loss, disturbance to nest sites.
Golden eagle (*Aquila chrysaetos*)	Bird – Raptor	BLM-SS	Migrates through Alaska and nests in interior Alaska, nests March to August uses upland tundra, mountain ridges; nests on cliffs and in tops of trees, forages on hares, ground squirrels, carrion, ungulate fawns, waterfowl, grouse.	Disturbance to nest sites, reduced prey availability due to habitat loss and alteration.
Olive-sided flycatcher *(Contopus cooperi)*	Bird – Passerine	BLM-SS	Nests throughout central Alaska, associated with forest openings, muskeg, meadows, burns, and logged areas; and with streams, ponds, bogs, lakes; use dead or partially dead trees.	Fire suppression, disturbance to nest sites, direct or indirect (through food web) exposure to contaminants.
Red knot (*Calidris canutus*)	Bird – Shorebird	BLM-SS	Arctic Alaska, generally west of the proposed Project along coast west of Harrison Bay.	Disturbance to nest sites; foraging or staging birds.
Rusty blackbird (*Euphagus carolinus*)	Bird – Passerine	BLM-SS	Breeds throughout central and southcentral Alaska; most commonly associated with boreal black spruce forest in spruce-alder-willow thickets in riparian areas or tundra-taiga transition.	Nesting habitat loss, disturbance to nest sites.
Short-eared owl *(Assio flammeus)*	Bird – Raptor	BLM-SS	Widespread throughout Alaska in lowland habitats, common breeder in north, northeast and interior Alaska, nests on ground in grass –lined depression, usually associated with marshes or grasslands; open habitats; preys on rodents, birds, insects.	Disturbance to nest sites, altered predator abundance or distribution, reduced prey availability due to habitat loss and alteration.
Trumpeter swan (*Cygnus buccinators*)	Bird – Waterfowl	BLM-SS	Interior and southcentral Alaska, nests on ponds, lakes and rivers with extensive submergent vegetation.	Disturbance to nest sites, staging habitats, reduced habitat suitability due to altered water quality.
Yellow-billed loon *(Gavia adamsii)*	Bird – Loon	BLM-SS; ESA-C	Arctic Alaska, most abundant west of Colville River, nests on large lakes usually near the coast; uses coastal marine waters; estimated 3,569 on Arctic Coastal Plain in 2009.	Disturbance to nest sites; foraging or staging birds, reduced habitat suitability due to altered water quality.

Key: BLM-SS = BLM Sensitive Species; ESA-C = ESA Candidate Species.

Sources: Avery 1995; BLM 2010; Harrington 2001; Hunt and Eliason 1999; Larned et al. 2010; MacDonald and Cook 2009; Mitchell and Eichholz 2010; North 1994; Wright 2008.

After construction, pipeline corridors may be used as travel corridors by wolves, coyotes, moose, and many other animals. Wildlife habitat fragmentation issues created by pipeline construction and operation include:

- Reduction in patch size of remaining available habitats;
- Creation of edge effects;
- Barriers to movement;
- Intrusion of invasive plants, animals, and nest parasites;
- Facilitation of predator movements;
- Habitat disturbance; and
- Intrusion of humans (Hinkle et al. 2002).

Habitat fragmentation effects would be most likely to occur in forested and shrubland habitats because the ROW would be maintained to a non-forested state. Clearing the ROW for construction through forested areas would reduce the habitat structure compared to herbaceous cover. The altered habitat would generally be reduced for pipeline corridors compared to road corridors because their widths are usually narrower, vegetation cover would be reestablished, and there is usually less human disturbance during operation (Hinkle et al. 2002). Fragmentation would be reduced substantially for the proposed Project due to burial of the pipeline, and the collocation with existing ROWs.

During construction, the pipeline could present a temporary physical and behavioral barrier for wildlife movement due to noise production from human activity. Operation of heavy equipment for clearing, grading, stringing and welding pipe together would all create noise and displace animals from the construction area through disturbance. The estimated time frame is 1 to 3 days that the pipeline trench would be opened and closed in sequence throughout the length of the proposed Project. The duration of disturbance at one location of the pipeline construction activity would likely occur for more than 3 days due to the staging and welding of pipe before trenching. The AGDC would minimize the duration of open-ditch construction activities and would develop systems or mechanisms to facilitate escape of wildlife from the pipeline trench to minimize the risk of animal entrapment (AGDC 2011). Details of these systems and mechanisms to prevent animal entrapment have not yet been determined.

To minimize vegetation impacts, the AGDC would develop a revegetation program in collaboration with the BLM and ADNR (see Section 5.23, Mitigation) which would adhere to ADNR's *Plant Materials Center Revegetation Manual for Alaska* (AGDC 2011). Seed mixes and fertilizers would be customized for site specific geographic areas throughout the ROW and applied at an optimum rate per acre. However, freshly seeded grasses can attract wildlife and are often preferentially grazed. Typically, seed mixes for reclamation include non-native plants that quickly establish vegetative cover to prevent soil erosion, but these plants often outcompete and do not allow subsequent reestablishment of native flora and vegetation structure (McKendrick 1997; TAPS Owners 2001). The permanent ROW would be maintained free of trees and shrubs resulting in long-term alteration of wildlife habitat structure and value (Hinkle et al. 2002). Subsequent revegetation potentially would not provide habitat features comparable to pre-project habitats. As noted above, the narrow area of disturbed habitat proposed for the proposed Project would be insignificant in relation to the vast amount of surrounding habitat that is available to wildlife. This development of the proposed Project would not be expected to limit habitat for wildlife.

Removal of vegetation also increases the potential for the establishment and spread of non-native weeds and other invasive plants that have little use or value for wildlife and that displace native plants resulting in degraded wildlife habitat values. The AGDC would develop a non-native invasive plant (NIP) Prevention Plan to prevent the introduction and spread of plants (AGDC 2011). The NIP Prevention Plan would provide details of the measures to control invasive species through appropriate site preparation, monitoring, revegetation of disturbed areas with native species, and performance standards. The AGDC would collaborate with BLM and ADNR to develop the NIP Prevention Plan. The development of the ROW would not likely cause a spread of plant pathogens. Tree diseases are often chronic in mature coastal forests and include heart rot fungi, dwarf mistletoe and root diseases in Alaska.

During the post-construction period, the proposed pipeline ROW, temporary access roads and new permanent access roads could potentially allow an increase in human activity within remote areas of the proposed Project. This could lead to increased wildlife disturbance with the potential to increase direct wildlife mortality from vehicle-animal collisions and legal and illegal harvest of wildlife. These new access corridors could increase indirect mortality through reduced reproduction due to displacement from habitat, increased stress, and increased predation. All-terrain vehicle (ATV) users could travel on portions of the ROW, either legally or illegally. Additionally, the construction of new roads, upgrades to existing roads, and the subsequent use of those roads generally would result in negative impacts to a wide range of wildlife (Hinkle et al. 2002; Jalkotzy, Ross, and Nasserden 1997; TAPS Owners 2001).

The AGDC would adopt motor vehicle and aircraft procedures that minimize disturbances to wildlife and would avoid or minimize operational activities during sensitive period such as moose and caribou calving bear denning, raptor nesting, and nesting migratory birds. Public access to the ROW would be limited for recreation or hunting by blocking entry areas with large boulders, berms, or fencing (AGDC 2011). Details on restricting hunter and ATV access into new developed wilderness areas produced by the proposed Project will be discussed with appropriate agency staff for mitigation purposes to prevent long term impacts to wildlife prior to proposed Project implementation (see Section 5.23, Mitigation).

5.5.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed; and there would be no direct or indirect impacts to wildlife or their habitats.

5.5.2.2 Proposed Action

The proposed Project would impact wildlife and their habitats as described above. Additional information on anticipated impacts to wildlife from specific proposed Project components is described below.

Pipeline Right-of-Way

<u>Mainline</u>

Construction

The primary impacts to wildlife from construction of the mainline ROW would be altered habitat either permanently or temporarily, and disturbance from noise as noted above. Other impacts could include increased mortality from vehicle and train collisions with wildlife due to proposed Project-related construction. Whenever possible, construction would be timed to occur outside of sensitive time periods for wildlife (i.e., calving, nesting, or migration seasons). Approximately 57 percent of the total pipeline construction would take place during the winter months and all construction on the North Slope would occur during the winter months to minimize impacts to wildlife and their habitats (see Section 5.23, Mitigation).

Vegetation clearing and grading necessary for pipeline construction could result in permanent habitat alteration that may leave some habitat unsuitable for some wildlife. Construction activities within the ROW (including TEWS) would result in removal of about 9,779 acres of wildlife habitat including 4,571 acres of upland forested habitats, and 5,208 acres of wetland habitats. Vegetation would reestablish over time in the construction ROW during the post construction phase of the proposed Project. Natural succession of the construction ROW would allow trees (soft and hardwood) to reach full maturity in years to decades. Trees would not be allowed to reestablish over the permanent ROW; therefore, the loss of forested habitats would be considered a permanent habitat impact. The development of the proposed Project would be a small amount of habitat impacted in comparison to the vast available surrounding habitat. Clearing forest in some areas would allow for the establishment of shrubs and forbs that could provide forage for moose and bears.

Construction of pipeline segments that have no existing ROWs, including the areas from Willow to the Natural Gas Liquid Extraction Plant (NGLEP) and the Minto Flats area would result in fragmentation of forested habitats. Construction in these areas would occur in one season and would result in temporary impacts to wildlife from construction noise and activity. The ROW corridor could open a travel corridor that could facilitate hunter access in this area. Mitigation plans developed by the AGDC would include blocking or removing access roads after construction to help prevent hunters from using this as a travel corridor. Construction of access roads would require removal of about 476 acres of upland wildlife habitat, and 172 acres of wetland habitats. Sensitive habitat including nesting, and breeding for birds and other wildlife would be avoided at the extent most possible during the construction under permitting requirements. The final location of facilities and the exact location of the pipeline would be determined later in the permitting process.

Transportation of the construction materials and supplies by rail line to Anchorage and Fairbanks would temporarily increase the frequency of trains along these routes which in turn could lead to an incremental increase in wildlife mortality due to collision with trains. Several sections of the rail line from Seward to Fairbanks have experienced significant rail collision mortality for moose during years with snow depths of more than 34 inches (Modafferi 1991). With the proposed increase in rail runs, the chance of increased mortality could also rise. The temporary increase in truck traffic associated with transportation of the pipeline materials and supplies could also increase wildlife mortality from vehicle collisions; small mammals and birds are especially susceptible. To minimize collisions with wildlife, the AGDC would adopt motor vehicle and aircraft procedures. These procedures will be developed as the proposed Project progresses.

Sensitive Wildlife Habitats

A list of BLM administered land for species of concern, life history, and their habitat expected along the area of the proposed ROW by milepost is included in Table 5.5-7. The proposed construction timing by segment is also included to indicate the potential for disturbance to species and their habitat. The areas and species of concern are Dall sheep (mineral licks, and lambing), raptors (nesting), moose (rut-breeding) and caribou (calving areas). Disturbance from construction activities could displace some wildlife, especially during sensitive breeding, calving, mineral lick and migration periods. As noted in Table 5.5-7, construction activities would occur primarily during the winter.

Dall Sheep

The proposed construction route may occur near habitats of concern for Dall sheep lambing or mineral lick areas. Construction would occur during the winter primarily, outside lambing periods, thereby avoiding disturbance to lambs and ewes (Table 5.5-7). The construction schedule proposed for the summer through the West Fork Atigun Area of Critical Environmental Concern (ACEC) could be located near important Dall sheep lambing areas and mineral licks. As stated by Summerfield (1974), lambing and mineral lick areas in the Atigun River valley are used primarily in late May through late June, but can vary from year to year. Potential impacts to Dall sheep habitat of concern would be unlikely.

Moose

Moose are found throughout the proposed Project area; however, rut and winter feeding periods would be the habitat of concern. None of the proposed construction activity would be scheduled to occur during moose rut periods (Table 5.5-7). Some winter feeding areas along the proposed Project route could potentially coincide with winter moose feeding areas; however, winter moose browsing habitat would not be limited by the construction of the proposed Project. AGDC would reduce impacts to the surrounding resources as practicable. Details on site specific land forms and moose use areas would be taken into consideration as the process develops for final location of pipeline, roads, and facilities.

TABLE 5.5-7 Potential Sensitive Wildlife Habitats along the Proposed Project ROW

Milepost	Name	Description	Proposed Construction Season
Parks Highway Route			
0 to 32	Waterfowl	Nesting habitat in spring	Winter
0 to 33	Caribou	Calving in summer	Winter
0 to 175	Caribou	Feeding in winter	Winter MP 0 to 163; Summer MP 163 to 183
19 to 41	Franklin Bluffs Peregrine Falcon ZRA	Nesting habitat in spring	Winter
47 to 51	Waterfowl	Nesting habitat in spring	Winter
55 to 63	Waterfowl	Nesting habitat in spring	Winter
62 to 66 and 64 to 74	Sagawon Bluffs Peregrine Falcon ZRA	Nesting habitat in spring	Winter
68 to 118	Moose	Feeding in winter	Winter
75 to 84	Waterfowl	Staging in spring and fall	Winter
115 to 125	Caribou	Migration route – North/South, crosses pipeline route	Winter
118 to 121	Slope Mountain Peregrine Falcon ZRA	Nesting habitat in spring and summer	Winter
122	Dall Sheep	Mineral lick area	Winter
124 to 126	Waterfowl	Migration route – North/South, crosses pipeline route	Winter
150 to 165	Waterfowl	Migration route – North/South, parallel to pipeline route	Winter MP 0 to 163; Summer MP 163 to 173
143 to 152	Galbraith Lake ACEC	Sensitive lambing areas and mineral licks for Dall sheep	Winter
146 to 170	Caribou	Migration route – North/South, parallel to pipeline route	Winter MP 0 to 163; Summer MP 163 to 173
155 to 175	Dall Sheep	Feeding in winter	Winter MP 0 to 163; Summer MP 163 to 183
163 to 170	West Fork Atigun ACEC	Dall sheep lambing habitat and mineral licks	Summer
147 to 176	Atigun Pass	Nesting raptors in spring and summer	Winter 2 MP 88 to 163 Summer 1 MP 163 to 173 Summer 2 MP 173 to 183
175 to 190	Caribou	Migration route – North, parallel to pipeline route	Summer MP 173 to 183; Winter MP 183 to 248
175 to 314	Caribou	Feeding in winter	Summer MP 173 to 183 and 286 to 348; Winter MP 183 to 248
184	Dall Sheep	Mineral lick area	Winter
190 to 226	Brown Bear	Spring feeding and berry area	Winter
197 to 207	Snowden Mountain ACEC	Dall sheep habitat and mineral lick area	Winter
223 to 228	Nugget Creek ACEC	Dall sheep lambing habitat and mineral licks	Winter
224 to 226	Poss Mountain ACEC	Dall sheep habitat and mineral lick area	Winter

TABLE 5.5-7 Potential Sensitive Wildlife Habitats along the Proposed Project ROW

Milepost	Name	Description	Proposed Construction Season
230 to 257	Brown Bear	Spring feeding and berry area	Winter
265 to 288	Jim River ACEC	Raptor habitat	Winter MP 183 to 286; Summer MP 286 to 348
302 to 306	Moose	Feeding in winter	Summer
358 to 362	Yukon River Peregrine Falcon ZRA	Nesting habitat for falcons and other raptors	Winter MP 358 to 360; Summer: MP 360 to 405
360 to 390	Moose	Feeding in winter	Summer
396 to 409	Moose	Feeding in winter	Summer MP 360 to 405; Winter MP 405 to 468
400 to 405	Waterfowl	Migration route – East/West, crosses pipeline route	Summer MP 360 to 405; Winter MP 405 to 468
412 to 426	Moose	Calving in spring	Winter
412 to 426	Moose	Feeding in winter	Winter
418 to 455	Minto Flats State Game Refuge	Waterfowl production and migration staging; abundant moose, black bear, and furbearers	Winter
417 to 425	Waterfowl	Nesting habitat	Winter
430 to 434	Waterfowl	Nesting habitat	Winter
430 to 442	Moose	Calving in spring	Winter
430 to 471	Moose	Feeding in winter	Winter
438 to 441	Waterfowl	Nesting habitat	Winter
445 to 471	Moose	Calving in spring	Winter
446 to 447	Waterfowl	Staging spring and fall	Winter
475 to 496	Moose	Calving in spring	Winter
475 to 500	Moose	Feeding in winter	Winter
493 to 530	Caribou	Feeding in winter	Winter MP 468 to 529; Summer MP 529 to 535
496 to 500	Moose	Rut (breeding) in fall	Winter
501 to 532	Waterfowl	Migration route – North/South, parallel to pipeline route	Winter MP 468 to 529; Summer MP 529 to 535
514 to 522	Moose	Rut (breeding) in fall	Winter
514 to 559	Moose	Feeding in winter	Winter MP 468 to 529; Summer MP 529 to 535; Fall/Winter MP 535 to 541; Summer MP 541 to 602
515	Caribou	Migration route – East/West, crosses pipeline route	Winter
522 to 559	Moose	Calving in spring	Winter MP 468 to 529; Summer MP 529 to 535; Fall/Winter MP 535 to 541; Summer MP 541 to 602
531 to 554	Alaska Range Foothills IBA	Golden eagle and other raptor	Summer MP 529 to 535;

TABLE 5.5-7 Potential Sensitive Wildlife Habitats along the Proposed Project ROW

Milepost	Name	Description	Proposed Construction Season
		nesting area	Fall/Winter MP 535 to 541; Summer MP 541 to 602
535 to 540	Brown Bear	Feeding in spring	Fall/Winter
590 to 597	Moose	Feeding in winter	Summer
602 to 635	Moose	Feeding in winter	Winter
602 to 635	Moose	Rut (breeding) in fall	Winter
650 to 659	Kahiltna Flats – Petersville Road IBA	Trumpeter Swan and Tule greater white-fronted geese	Winter
660 to 718	Moose	Feeding in winter	Winter
674 to 709	Moose	Calving in spring	Winter
713 to 716	Moose	Calving in spring	Winter
723 to 734	Waterfowl	Staging in fall (migration)	Winter
718 to 724	Moose	Calving in spring	Winter
724 to 736	Moose	Feeding in winter	Winter
732 to 734	Susitna Flats IBA	Spring and fall migrant ducks, geese, swans, and sandhill cranes	Winter
738 to 741	Waterfowl	Staging in fall (migration)	Fall
Denali National Park Route Variation			
535 to 540	Brown Bear	Feeding in spring	Fall/Winter
535 to 555	Caribou	Calving in summer	Fall/Winter MP 535 to 541; Summer MP 541 to 602
535 to 555	Caribou	Feeding in winter	Fall/Winter MP 535 to 541; Summer MP 541 to 602
Fairbanks Lateral			
0 to 35	Moose	Calving in spring	Summer
0 to 35	Moose	Feeding in winter	Summer

ADF&G Habitat Atlas (1:1,000,000 scale) Arctic, Interior, South-central (ADF&G 1985; ADF&G 1986a, b, and c).

ZRA = zone of restricted activity; ACEC = areas of critical ecological concern; IBA = Important Bird Area.

Source: Alaska Pipeline Service Company 2002, EA_119, Second Edition, May 2002; Audubon Alaska 2008; Trans Alaska Pipeline System Owners 2001, Volume 1.

Caribou

Caribou are found throughout the North Slope Coastal Plain but occur in the highest numbers during the summer near the coast when calving occurs. Development of the proposed Project would occur during the winter months only, which would substantially reduce impacts to caribou populations. Construction activity over one season could displace caribou that migrate during the winter near the proposed ROW. Human made noise and activity with heavy equipment and pipe stringing could cause caribou to divert their path of travel, which could impact subsistence resources for Arctic Plains residents. AGDC would avoid constructing in areas and during a time period that caribou are known to migrate through to reduce impacts as practicable (see Section 5.14, Subsistence).

<u>Birds</u>

Impacts to birds during construction would be minimized due to timing the construction to occur during the winter months. Approximately 57 percent of the total pipeline construction would take place during the winter months and all of the construction on the North Slope would occur during the winter months when migratory birds are not present. All considerations will be taken into account to prevent disturbance to migratory breeding birds during the construction of the ROW. Nesting areas would be avoided during sensitive time periods to the extent most practicable to prevent disturbance of the proposed Project (Table 5.5-7).

Exceptions to the winter construction season could be in areas of the Yukon River Peregrine Falcon zone of restricted activity (ZRA) (MP 360-362), the Jim River ACEC (MP 286-288), and the Alaska Range Foothills IBA (MP 531-535 and 542-554). The BLM has information on nesting raptors along the Dalton Highway/TAPS corridor. This information would be supplied to AGDC when needed (BLM Pers. Comm 2012). However, aerial surveys of nesting raptors would be required prior to proposed Project construction activities to comply with permit requirements and the MBTA, and BGEPA.

Construction of the pipeline corridor and permanent access roads would occur over 2 years, and disturbance could cause some alteration of habitat such that the area may not be suitable for some species of birds. Displacement of birds would occur along the segment of pipeline where construction activities occur; however, the development of the proposed Project would not limit nesting habitat for birds. The area proposed for disturbance would be relatively insignificant in size compared to the surrounding available nesting habitat.

Yukon River Crossing Options

<u>The Applicant's Preferred Option</u>: The first option would be to construct a suspension bridge across the Yukon River. Approximately 8.6 more acres of wetlands could be impacted with development of the suspension bridge compared to Option 2. This option would impact 48 percent more forested vegetation. Seven percent of the area is currently developed; the remaining amount would be open water and wetlands (see Section 5.4, Wetlands for details). The forested habitat lost for this option would be substantial compared to utilizing the existing bridge. Wildlife inhabiting the proposed construction area that relies on forest vegetation would be impacted by a loss of forest habitat. The development of the proposed Project would not limit habitat for wildlife.

<u>Option 2</u>: The second option would be to utilize the existing E.L. Patton Yukon River Bridge. This option would result in 23 percent forested habitat impacted, 54 percent of the land is currently developed, 3 percent scrub/shrub and the remaining 20 percent is open water and wetlands (see Section 5.4, Wetlands).

<u>Option 3</u>: The third option would be to cross the Yukon River via Horizontal Directional Drilling at the same location as the proposed suspension bridge. One acre construction pads would be

needed at each side of the river located within the construction ROW of the proposed new suspension bridge. Thus, disturbance to wildlife habitats would be identical to the Applicant's Preferred Option. Similar wildlife impacts posed for Option 2 would apply to Option 3 due to forested habitat removal and maintenance.

Operations and Maintenance

Aerial and ground-based pipeline inspections would have the potential to cause some temporary disturbance to some wildlife if activities were to occur during sensitive periods (e.g., calving or nesting periods). Monitoring activity may result in decreased habitat suitability along the proposed pipeline corridor for those species that may be particularly sensitive to and that avoid human activity.

Permit approval would be required to determine the timing of mowing activities of the permanent ROW to occur outside of nesting activities for birds. Some birds nest on or near the ground and are protected under the MBTA. The proposed Project would be located within existing ROWs (highways, TAPS ROW, and utility lines) the majority of it length; therefore, additional access to sensitive wildlife areas would be minimal. Lighting installed at permanent facilities may deter wildlife when initially placed, but wildlife would likely habituate to the lighted area around facilities.

Maintenance of access roads would require removal of approximately 362 acres of wildlife habitat, which includes approximately 229 acres of forested habitat and 134 acres of wetland habitat (Table 5.5-8). Acreage calculated for access road totals is for the portion of 50-foot wide ROW of access roads that falls outside the permanent and construction ROW. Those lands along access roads within the permanent or construction ROW are accounted for in the vegetation numbers for those facilities. For this reason, the total area of construction access roads may be smaller than those associated with the permanent access roads.

Access road maintenance in the winter may cause wildlife mortality from collisions if wildlife is attracted to salts spread on the road to accelerate snow melting. Wildlife such as moose may be attracted to grass planted along roadsides from hydro seed application to establish vegetative growth to prevent erosion. This may cause an increase in mortality to moose and other wildlife attracted to roads. Dust from road use, causes the snow to melt along roadsides, exposing vegetation faster than the areas that do not receive dust from the road. Wildlife colliding with vehicles could increase causing mortality due to the attraction of exposed vegetation. The proposed Project would mitigate access of motorized ATVs to sensitive wildlife areas that were previously inaccessible. Fencing or road barriers and pillars may be used to prevent the public from accessing wilderness areas. Fencing used to block off the ROW access points to hunters and ATVs may impede wildlife movement. These potential impacts to wildlife would be addressed in an agency approved mitigation plan in order to reduce the likelihood of impacts to wildlife from proposed Project development.

TABLE 5.5-8 Estimated Temporary Wildlife Habitat Loss for the Proposed Project Areas (Acres)

	MP 0 – MP 540		Fairbanks Lateral		MP 540 – MP 555		Denali National Park Route Variation	MP 555 - END			
Description[1]	Construction ROW (Acres)	TEWs (Acres)	Construction ROW (Acres)	Access Roads (Acres)	Construction ROW (Acres)	TEWs (Acres)	Construction ROW (Acres)	Construction ROW (Acres)	TEWs (Acres)	Mainline Access Roads (Acres)	Project Total (Acres)
Open Water	43.1	2.8	0.8	0.0	2.8	0.5	1.6	7.5	1.2	0.2	60.5
Deciduous Forest	458.3	45.0	34.5	20.5	6.8	0.2	0.0	543.5	77.9	65.2	1,251.9
Evergreen Forest	1,621.6	209.3	110.9	47.0	278.6	20.2	67.5	213.0	33.5	124.0	2,725.6
Mixed Forest	196.5	25.5	7.8	13.7	20.1	1.8	3.2	536.5	58.7	38.2	902.0
Grassland / Herbaceous	13.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	15.7
Agriculture	2.1	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	11.4
Forested Habitats	**2,292.4**	**280.2**	**153.2**	**81.2**	**305.5**	**22.2**	**70.7**	**1,302.3**	**170.1**	**228.8**	**4,906.6**
Dwarf Scrub	755.7	79.2	0.0	0.0	0.2	0.0	1.5	3.4	0.0	7.9	847.9
Scrub/Shrub	1,026.4	128.0	7.7	4.4	109.7	6.4	11.9	242.2	22.5	109.8	1,669.0
Sedge Herbaceous	743.2	74.6	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.9	821.3
Woody Wetlands	329.4	44.8	241.7	7.4	29.3	0.3	2.1	119.7	24.3	13.0	812.0
Wetland Habitats	**2,854.7**	**326.6**	**249.4**	**11.8**	**139.2**	**6.7**	**15.5**	**365.6**	**47.1**	**133.6**	**4,150.2**
Total Habitat Area	**5,190.20**	**609.60**	**403.40**	**93.00**	**447.50**	**29.40**	**87.80**	**1,676.40**	**218.37**	**362.60**	**9,117.30**

[a] Habitat impacts include the 100-foot ROW.

[b] Denali National Park Route Variation not included.

Source: Homer et al. 2004 (National Land Cover Dataset). Acreage calculations are based on 100-foot wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012).

Fairbanks Lateral

Construction

The Fairbanks Lateral is routed through the riparian corridor of the Goldstream Creek which is occupied by a rail corridor. Additional construction through this riparian area could contribute to additional habitat fragmentation which may reduce the suitability of this area to support some nesting landbirds. Vegetation clearing prior to construction would affect 403 acres of primarily wetland habitat of the ROW (Table 5.5-8). In addition, construction of access roads for the Fairbanks Lateral would require removal of approximately 93 acres of wildlife habitat, including approximately 81 acres of forested habitats and 12 acres of wetland habitats (Table 5.5-8).

Operations and Maintenance

The access roads developed in association with the Fairbanks Lateral and mainline in this area may facilitate hunter access to this region. ATVs could potentially cause damage to surrounding wetlands and vegetation which could take a long time to recover. The AGDC would block or remove access roads after construction to help prevent hunters from using access roads as a travel corridor. Signs would be erected to keep recreational vehicles out.

Maintenance of access roads for the Fairbanks Lateral would require removal of the same habitat acreage as the construction ROW as noted above. Acreage calculated for access roads is for only the portion of the 50-foot wide ROW of access roads that falls outside the permanent and construction ROW. Those lands along access roads within the permanent or construction ROWs are accounted for in the vegetation numbers for those facilities. For this reason, the total area of construction access roads may be smaller than those associated with the permanent access roads.

Aboveground Facilities

Gas Conditioning Facility

Construction

Equipment staging prior to construction and post-construction grading during the summer would likely displace some caribou from this area and potentially delay movements through the area of the GCF. Most construction along the pipeline corridor would occur during winter; however, when most of the caribou have left the oil field area. Construction of the GCF would result in 68.5 acres of emergent herbaceous wetland habitat and 0.3 acre of open water to be permanently lost to wildlife (Table 5.5-9). The first 6 miles of pipeline extending from the CGF would be aboveground and placed on VSMs approximately 7 feet above the ground to allow for wildlife movement.

TABLE 5.5-9 Habitat Acreage Affected by Aboveground Facilities

Habitat	Operational Footprint (acres)					
	GCF	Compressor Station (MP 225)	Compressor Station (MP 286.6)	Compressor Station (MP 458.1)	Straddle and Off-Take Facility (MP 458.1)	NGLEP Facility (MP 736.4)
Open Water	0.3	0.0	0.0	0.0	0.0	0.0
Evergreen Forest	0.0	0.0	1.3	1.4	0.8	3.0
Deciduous Forest	0.0	0.0	0.0	<0.1	2.6	0.0
Mixed Forest	0.0	0.0	0.0	0.0	0.0	1.7
Total Forested Habitats	0.0	0.0	1.3	1.4	3.4	4.7
Emergent Herbaceous Wetlands	68.5	0.0	0.0	0.0	0.0	0.1
Shrub/Scrub Wetlands	0.0	1.4	0.2	0.0	0.0	0.0
Total Wetland Habitats	68.5	1.4	0.2	0.0	0.0	0.1
Total Wildlife Habitat Area[a]	68.7	1.4	1.4	1.4	3.3	4.8

[a] The sum of the individual entries may not match the overall total due to rounding.

Operations and Maintenance

Operation of the GCF would result in personnel traffic to and from pads and camps that could result in some delay of movement for caribou, and collision mortality to foxes and birds. Mortality to wildlife from vehicle collisions would be uncommon due to the slow and highly regulated driving speeds in the North Slope oilfields.

Common raven populations could increase with development of infrastructure for nesting, in particular in the Arctic Coastal Plain. Common ravens are considered subsidized predators and may affect prey abundance, distribution, and demography (Kristan and Boarman 2007). Common ravens in the Prudhoe Bay area feed on shorebird and waterfowl eggs, lemmings, fledglings, and garbage in dumpsters and landfills. Human-provided food resources are thought to be important drivers of raven population growth, and human developments add other features as well, such as nesting platforms (Kristan and Boarman 2007).

The development of infrastructure could result in an unnatural increase in Arctic fox and red fox populations. Materials and facilities needed for development of the proposed Project can provide artificial shelters as denning habitat for mothers with pups. The proposed Project includes the construction of the GCF which would not likely produce substantial denning habitat or feeding opportunities for fox species beyond what currently exists in Prudhoe Bay. Human waste in garbage dumpsters or landfills can subsidize population growth of these species. There are also safety concerns with the potential for rabies outbreaks when fox populations reach unnaturally high levels and are associated with anthropogenic resources. Fox species and the common raven are opportunistic predators which feed on birds' eggs, and young birds; however, predator populations would not likely increase due to the development of the GCF. Mitigation measures would be developed between AGDC and ADFG to prevent denning or nesting opportunities of subsidized predators. This may include placing material (netting, enclosed material) under and above beams where ravens like to nest (see Section 5.23, Mitigation).

Compressor Stations

Construction

Disturbance from construction could displace some wildlife, especially construction activities that occur during sensitive nesting or calving, periods. Construction of compressor stations would result in the permanent loss of 2.7 acres of forested habitats and 1.6 acres of shrub/scrub wetland habitats for wildlife (Table 5.5-9). This impact could result in the loss of existing nesting sites for bird species like the bald eagle that use nest locations repeatedly. Some species are more susceptible to noise and human disturbance than others, which would likely displace these species from the area permanently. Final locations of facilities would be determined at a later date following additional consultation and design of the proposed Project. Impacts to humans and wildlife routes or use areas would be reduced by AGDC the most practicable.

Operations and Maintenance

Noise from compressor stations may displace a few nesting birds and cause avoidance of the area by ungulates during sensitive calving or lambing periods. Most wildlife would likely habituate to the noise and human activity around the facilities over time.

Cook Inlet Natural Gas Liquids Extraction Plant Facility

Construction

Construction of the Cook Inlet NGLEP Facility could disturb wildlife if activities occurred during the calving period for moose and would result in 4.7 acres of forested habitats and 0.1 acre of emergent herbaceous wetland habitat to be permanently lost for wildlife (Table 5.5-9). Nesting habitat for tree nesters could be impacted permanently from the loss of forest canopy. Cover and habitat for other nesting birds and small furbearers would be impacted by fragmentation or the loss of territories or home ranges needed for breeding.

Operations and Maintenance

Operation of the extraction plant would require permanent employees which would in turn increase vehicle traffic in the area potentially resulting in increased moose-vehicle collisions.

Straddle and Off-Take Facility

Construction

Construction of the Fairbanks Lateral straddle and off-take facility would result in 3.3 acres of forested habitats to be permanently lost for wildlife (Table 5.5-9). This could potentially result in a loss of nesting habitat for birds, and cover for large game animals.

Operations and Maintenance

The straddle and off-take facility would be installed at the proposed Fairbanks lateral tie-in to provide utility grade natural gas, primarily through the removal of natural gas liquids (NGL), prior to sending natural gas into the Fairbanks Lateral. Operation of the straddle and off-take facility would create disturbance to wildlife initially from noise and human activity; however, wildlife would be expected to habituate to the noise and human activity around the facility over time. Vehicle collisions with small game and large game could occur from increased activity and use of access roads. Salts spread on roads in the winter may attract large game as they lick the salt off the roads which may increase mortality from vehicle collisions.

Support Facilities

Construction Camps and Pipeline Yards

Operation of construction camps creates the potential for bear-human interactions and attraction of wildlife to the site by odors from foods. Bears that have been allowed to access human foods may be attracted to camps and can pose a threat to human safety. In some instances bears may be shot and killed to protect human life. Increased vehicle traffic on secondary roads would lead to increased wildlife-vehicle collision mortality.

5.5.2.3 Denali National Park Route Variation

Construction

The Denali National Park Route Variation would be located along the Parks Highway corridor. As a result, this route variation would have a substantial quantity of developed (low intensity) and barren land within the proposed ROW (Table 5.3-2). The Denali National Park Route Variation would remove approximately 23 percent of the forest acreage and 11 percent of the wetland acreage as the corresponding proposed MP 540 to MP 555 Project segment (Table 5.5-8).

Operation

General operational impacts associated with the Denali National Park Route Variation would be similar to those described for the corresponding mainline segment with the exception of NIP exposure. It is likely that during operations of the proposed Project, the Denali National Park Route Variation would encounter frequent exposure of noxious plants than the mainline route (MP 540 to MP 555) due to its location. Noxious weed exposure would occur continually along the Denali National Park Route Variation ROW from regular vehicular traffic and human use of the Parks Highway. The mainline MP 540 to MP 555 would be located away from the Parks Highway and would not receive regular exposure of noxious weeds due to its location. The risk of the spread of invasive plants would be greater for this alternative than it would be for the corresponding mainline segment. Continual exposure of invasive plants along the ROW would require a more extensive mitigation and monitoring plan (see Section 5.23, Mitigation). Non-native and invasive plants often have little use or value for wildlife and displace native vegetation, resulting in degraded wildlife habitats.

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5.5.3.1 Personal Communications

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5.6 FISH

This section describes the fish species that inhabit waterbodies that cross and are adjacent to the 737 mile proposed Project right-of-way (ROW) from the Arctic Coastal Plain to Southcentral Alaska. It includes the Fairbanks Lateral, aboveground facilities, support facilities, and the Denali National Park Route Variation. Resident and anadromous fish species in association with essential fish habitat are discussed in this section to illustrate the affected environment and environmental consequences of the proposed Project. The AGDC has proposed mitigation measures to reduce impacts to fish resources, which is included in Section 5.23.2.6.

5.6.1 Affected Environment

The proposed Project area (mainline and associated facilities) extends approximately 737 miles from Prudhoe Bay in the North Slope Borough to the Matanuska-Susitna (Mat-Su) Borough near the Upper Cook Inlet (Figure 1.0-1). The Fairbanks Lateral would diverge from the proposed mainline at approximate MP 458 (MP FL 0.0) at Dunbar in the Yukon Koyukuk Census Area and extend approximately 34 miles east through the Fairbanks North Star Borough (FNSB) to Fairbanks. Freshwater habitat throughout the proposed Project area includes lakes, ponds, wetlands, streams (ephemeral and perennial), and large and small rivers. Fish habitat is important for spawning, foraging, rearing, incubation, refuge, migration and overwintering purposes.

Three main types of fish are included in the waters transected by the proposed Project area, including anadromous, resident, and amphidromous fish species. Fish that spend most of their lives at sea and return to freshwaters only to spawn are termed anadromous fish. These species primarily include salmon. Fish that reside in freshwater for their entire lifecycle are called resident fish, which include Arctic grayling, burbot, and lake trout (Reynolds 1997). Amphidromous species move between fresh and marine waters at certain life stages, such as feeding at sea during the summer and spending the winter and spawning in freshwater. Amphidromous fish include Dolly Varden, Arctic char, Arctic cisco, and Broad whitefish. In the following section, amphidromous species are included with the anadromous species category and streams will either be defined as having resident or anadromous fish present.

Anadromous fish species are protected under AS 16.05.871. “Waters Important to Anadromous Fish” [5AAC 95.010] are defined by the Alaska Administrative Code as those waters important for spawning, rearing, or migrating anadromous fishes. *The Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* and its companion Atlas identify such waters. This catalog is divided into Alaska’s six fish and game resource management regions. The volumes that encompass the Arctic, Interior and Southcentral management regions (Johnson and Blanche 2011a, 2011b, 2011c) were used to identify waterbodies used by anadromous fish within the proposed Project area.

Anadromous fish may be found in streams not currently designated as anadromous fish streams in the catalog. Waterbodies in the catalog represents less than 50 percent of the streams, rivers and lakes actually used by anadromous species (ADF&G 2011a). All species of Pacific salmon known to inhabit Alaskan watersheds migrate through and populate various habitat types seasonally at different times depending on life history stage and watershed of origin (Hilborne 2003). Larger environmental influences and genetics may also play a role in specific stock run timing (Hodgson and Quinn 2002, Schindler et al. 2010). Adult immigration and smolt emigration timing is important for determining the proposed Project schedule and design.

Essential Fish Habitat

The National Marine Fisheries Service (NMFS) along with Alaska Department of Fish and Game (ADF&G) and other agencies work together to identify and protect essential fish habitat (EFH) for federally managed fish species. The Magnuson-Stevens Fish Conservation and Management Act (MSFCMA) defines EFH as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity.” Freshwater EFH in Alaska includes all the lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon (Pacific Fish Management Council 2010). All five Pacific salmon stocks (pink, sockeye, chum, coho, and Chinook) found in Alaska are protected under the MSFCMA. EFH includes all life stages, including egg (incubation in gravel), larval, juvenile, and adult in the freshwater and marine environment. These areas are identified in *ADF&Gs Catalogue of Waters Important for Spawning, Rearing and Migration of Anadromous Fishes* (ADF&G 2011a).

All federal agencies are required to consult with NMFS on all actions or proposed actions permitted, funded, or undertaken by the agency that may adversely affect EFH (NMFS 2004). An adverse effect is defined as any impact that reduces quality and/or quantity of EFH. This includes direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to species and their habitat, and other ecosystem components, or reduction of the quality and/or quantity of EFH (NMFS 2004). Adverse effects may result from actions occurring within EFH or outside of EFH.

Collaboration between the Alaska Gasline Development Corporation (AGDC) and the NMFS would be required through the Essential Fish Habitat Consultation Guidance of the MSA Section 305(b) (4)(A) (2004) and the Anadromous Salmonid Passage Facility Design (NMFS 2011). Each stream crossing proposed would require an approved ADF&G Fish Habitat Permit, which would include the necessary site specific fish resource data to comply with permit requirements. The permit application process would determine the appropriate site specific crossing methods (open cut, open-cut isolation, HDD, or bridge) for protection of EFH. AGDC proposed mitigation for fish resources is included in Section 5.23.2.6.

Fish sensitivity is determined by spawning and incubation periods as well as fry emergence, rearing, overwintering, and migration periods. Fish are considered particularly sensitive during their spawning, egg incubation and fry emergence periods (Weber-Scannell and Duffy 2007, Kyle and Brabets 2001). Overwintering habitat in the Arctic and subarctic regions of the proposed Project area are also of particular concern. Many of the waterbodies in the Arctic are too shallow to support fish during the winter (Truett and Johnson 2000). Fish can become stressed by cold temperatures and low food availability (BLM 2002). Ice depth in Arctic lakes can approach 6.5 feet thick and freshwater fish must migrate to waters deeper than 6.5 feet that do not freeze entirely to survive (Truett and Johnson 2000). Perennial springs are critical overwintering habitat in Arctic regions because much of the drainage freezes solid (Reynolds 1997). These sites are usually quite localized and provide small, stable discharges (less than 3 feet per second) of groundwater well above freezing temperatures (39.2˚F to 42.8˚F) (Reynolds 1997). Consequently, if water flow is altered in an overwintering area or if the water quality is degraded, a large portion of a fish population can be impacted (BLM 2002).

5.6.1.1 Project Area

Fish resources are categorized in the proposed Project area by three major hydrologic regions:1) North Slope region, north of the Brooks Range including the northern portion of GCF to MP 540 Segment (Sagavanirktok River drainage); 2) Interior Alaska, from the Brooks Range to the Alaska Range including southern portion of GCF to MP 540 Segment; MP 540-MP 555; northern portion of MP 555 to Cook Inlet; Fairbanks Lateral; and Denali National Park Route Variation (Yukon and Tanana River drainages); and 3) Southcentral Alaska, Project area south of the Alaska Range, including the southern portion of MP 555 to Cook Inlet (Susitna River drainage) (Figure 5.6-1).

Thirty species of fish have been confirmed or have the potential to occur throughout some part of their lifecycle within the proposed Project area (Table 5.6-1) (ADF&G 2010). Anadromous species have been identified within the proposed Project area at specified stream crossing locations, which are included in Appendix E. Stream crossings were determined to support anadromous fish if they: 1) are cataloged anadromous waters (Johnson and Blanche 2011a, 2011b, and 2011c; 2) are connected to a cataloged anadromous water; or 3) if stream sampling along the proposed Project during the summer of 2010 yielded anadromous fish. The proposed Project would cross 516 streams throughout the three hydrologic regions. Eighty-two of the stream crossings have been confirmed to possess anadromous fish, the majority of which are located in the Southcentral region of Alaska (Table 5.6-2). Confirmed anadromous species and the life stage present at each stream crossing are listed by hydroregion in Appendix E. Confirmed resident fish species at each stream crossing are also presented in Appendix E. None of the confirmed fish species are considered to be Sensitive Species by the Bureau of Land Management (BLM) (Matthew Varner, Pers. Comm. 2010).

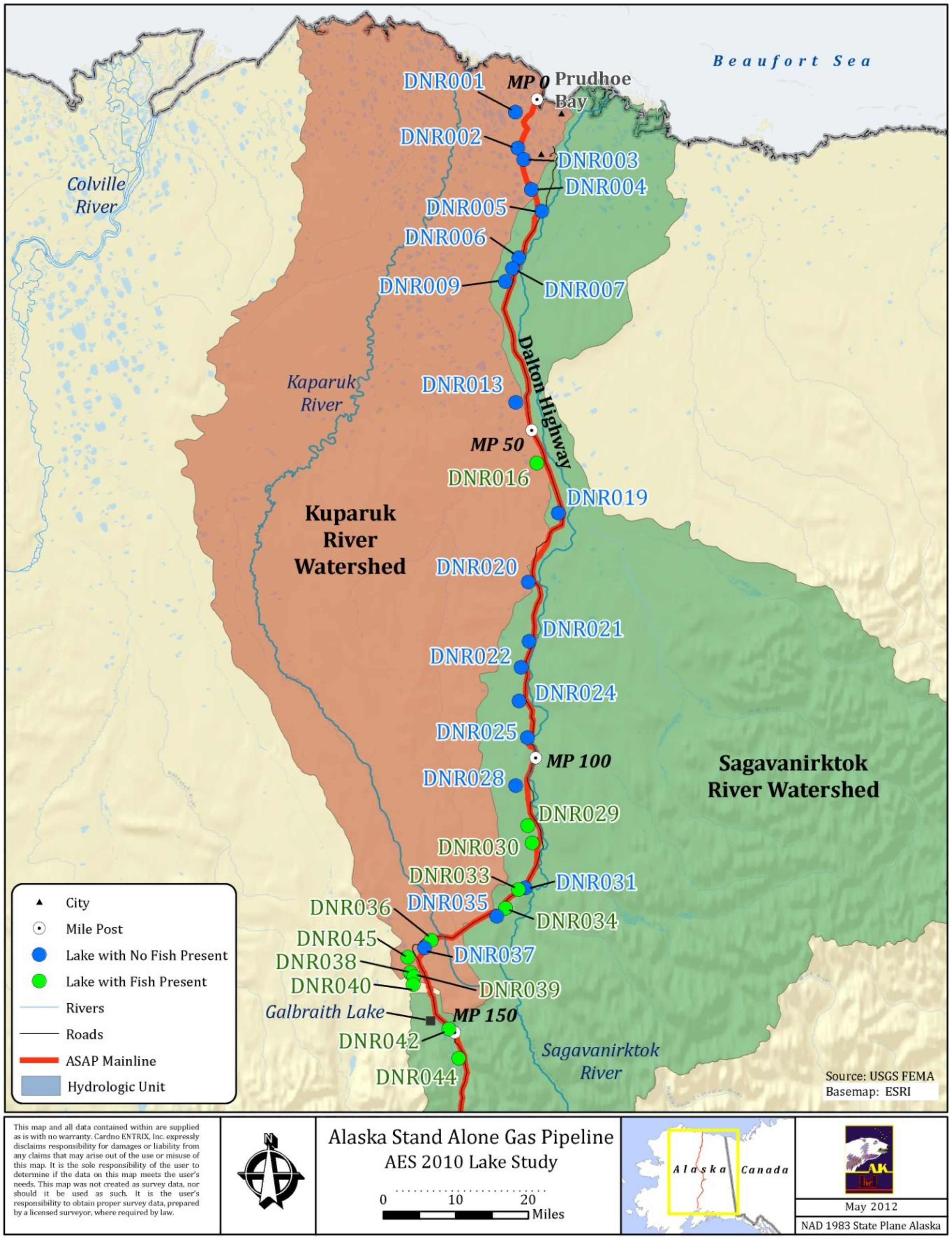


FIGURE 5.6-1 Lake Study Area

TABLE 5.6-1 Fish Species Inhabiting Waterbodies Crossed by the Proposed Project

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	Southcentral		
Arctic lamprey	*Lampetra japonica*	X	X	X	Yes	Occur from Arctic coast to Kenai Peninsula; Yukon River into Yukon Territory, Kuskokwim and Tanana river drainages. Adults feed at sea or in lakes; spawn in clear streams. Ammocoetes (lamprey larva) in muddy margins and backwaters of rivers and lakes.
Pacific lamprey	*Lampetra tridentata*			X	Yes	Occur along coastal areas from Nome down to California. Remain as an ammocoetes for 4-5 years then metamorphose and move to sea. Feed at sea for approximately 1 year, then return to fresh water in the fall and spawn the following spring.
Lake chub	*Couesius plumbeus*		X		No	Found throughout the Yukon River upstream of Nulato and in its tributaries, including the Tanana drainage. Found most often in shallow, silty lakes and streams in Alaska. Spawns in shallow waters with gravelly bottoms during summer.
Longnose sucker	*Catostomus catostomus*	X	X	X	No	Found throughout mainland Alaska in lakes and streams with clear cold water. Spawns in streams, lakes, or ponds with gravel bottoms and cold water in late spring or early summer.
Northern pike	*Esox lucius*		X	X	No	Occurs in the Colville, Yukon, and Susitna River Basins. Prefers clear vegetated lakes, quiet pools and backwaters of creeks and rivers; spawns in marshy areas. Voracious predator on juvenile salmonids, the Northern pike is native to most of Alaska, but is considered an invasive species south and east of the Alaska Range except for a small population near Yakutat.
Alaska blackfish	*Dallia pectoralis*		X	X	No	Occurs throughout mainland Alaska west of Colville River along Arctic coast, also in the Yukon-Tanana drainage and lakes in the Anchorage area. Bottom-dwelling fish found in heavily vegetated swamps and ponds, lakes and rivers. Migrates to deep waters in winter. Natives have used blackfish extensively for food.
Pond smelt	*Hypomesus olidus*	X		X	No	Found in Beaufort Sea drainages and the Copper River drainage. Found in middle and surface water of ponds, lakes and streams. Occasionally enters brackish waters.
Rainbow smelt	Osmerus mordax	X			Yes	Occur throughout coastal Alaska. Ascend freshwater streams only a few hundred yards to a mile to spawn.
Eulachon	*Thaleicchthys pacificus*			X	Yes	Found in the Copper River Delta; also the Susitna, and 20-mile rivers in Cook Inlet. Spawn during spring in the lower reaches of rivers or streams with sandy gravel bottoms. Grow to maturity in the sea where they feed mainly on krill. Important as a personal use and subsistence species.
Inconnu (sheefish)	*Stenodus leucichthys*		X		Yes	Found in the Yukon river drainages along the proposed ROW. Minto Flats and Upper Yukon River populations are year round residents. Spawn in rivers with a fast current over a bottom composed of differentially-sized gravel; sheefish may live to spawn several times.
Least cisco	*Coregonus sardinella*	X	X		Yes	Found from Arctic coast to Bristol Bay and in most lakes and streams north of the

TABLE 5.6-1 Fish Species Inhabiting Waterbodies Crossed by the Proposed Project

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	Southcentral		
						Alaska Range and throughout the Yukon and Kuskokwim drainages. Anadromous and landlocked freshwater forms exist. Anadromous forms have an annual migration from freshwater winter habitats to saltwater summer feeding habitats. Mature fish migrate upstream in the fall to spawn in clear streams with gravel bottoms north of the Alaska Range.
Arctic cisco	*Coregonus autumnalis*	X	X		Yes	Occur from the Point Barrow area eastward along the Beaufort Sea coast to the Canada border, occurring mainly in the Colville River area, with limited distributions in the Sagavanirktok and Putuligayuk rivers. Tolerant of high salinity and often found in estuaries. One of the most abundant and valued subsistence species along Alaska's North Slope.
Bering cisco	*Coregonus laurettae*	X	X		Yes	Found in the Yukon River upstream to Ft. Yukon. Primarily freshwater and coastal marine; winter in salt or brackish water near river mouths; undergo extensive spawning migrations up the Yukon River where they spawn in fast-flowing water near beds of loose gravel.
Broad whitefish	*Coregonus nasus*	X	X		Yes	Found in the Yukon and Kuskokwim river drainages and in the Bering, Chukchi, and Beaufort Sea river drainages. Primarily found in streams, less often in lakes and estuaries. Spawn over a gravel bottom in the fall. In the Yukon River, broad whitefish are important for local consumption and for commercial purposes. Both spawning and overwintering populations occur in the Sagavanirktok River and Yukon River drainages.
Lake whitefish	*Coregonus clupeaformis*			X	No	Occur in the Copper and Susitna river drainages. Found in the deeper, colder areas of lakes and rivers in summer. Moves to shallower areas to spawn in fall.
Humpback whitefish	*Coregonus pidschian*	X	X	X	Yes	Found in all drainages north of the Alaska Range as well as in the Copper and Susitna rivers. Spawn during the fall at the upper reaches of rivers over a gravel bottom at 4-5 years of age. Important in the subsistence economy of rural Alaskans.
Round whitefish	*Prosopium cylindraceum*	X	X	X	No	Widespread on mainland Alaska from North Slope to Taku River. Occur in shallow areas of lakes and clear rivers and streams; rarely in brackish water. Spawn over gravel shoals of lakes and at river mouths.
Arctic grayling	*Thymallus arcticus*	X	X	X	No	Widespread on mainland Alaska; both migratory and resident population occur. Winter primarily in cold waters of medium-sized to large rivers and lakes; migrating to rocky streams to breed in spring and then continuing to separate summer feeding grounds.
Lake trout	*Salvelinus namaycush*	X	X	X	No	Inhabit clear, mountain lakes in the Brooks Range, Alaska Range, and central Arctic coastal plain. Found in turbid glacial lakes on the north side of the Chugach Range and Kenai Peninsula. Spawn over clean, nearshore rocky shoals in fall.
Dolly Varden	*Salvelinus malma*	X	X	X	Yes	Locally abundant in all coastal waters of Alaska. Anadromous and freshwater resident varieties exist. Mature sea-run Dolly Varden spend their lives migrating from wintering

TABLE 5.6-1 Fish Species Inhabiting Waterbodies Crossed by the Proposed Project

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	Southcentral		
						fresh water to saltwater summer feeding areas, then back to freshwater rivers to spawn in the fall. One of Alaska's most important and sought-after sport fish.
Rainbow trout (steelhead)	*Oncorhynchus mykiss*		X	X	Yes	Resident and anadromous forms exist. Occur naturally in the coastal waters of the Upper Cook Inlet and the Copper River drainage. Hatchery-reared fish occur in specific lakes and streams in the Tanana River drainage. Spawn in shallow riffles or suitable clear water streams. One of the most respected and sought after of Alaska's native game fishes. The Gulkana River is the most northern population extent of rainbow trout (BLM Pers. Comm 2012).
Pink (humpback) salmon	*Oncorhynchus gorbuscha*	X		X	Yes	Occur along Alaska's coasts. Spawn between late June and mid-October, usually within a few miles of the coast or in the intertidal zones. Young run to sea right after emerging from gravel where they remain for 2 years before returning to spawn. Important to commercial and sport fisheries and to subsistence users in Alaska.
Coho (silver) salmon	*Oncorhynchus kisutch*		X	X	Yes	Found in coastal waters of Southeast and South-central Alaska and in the Yukon River to the Alaska-Yukon border. Occur in nearly all accessible bodies of fresh water; avoid riffles. Spawn in streams from July to November. Young migrate to sea between 1 and 4 years, remaining at sea for 2-3 years. Premier sport fish of Alaska occurs in both fresh and salt water from July to September.
Chinook (king) salmon	*Oncorhynchus tshawytscha*		X	X	Yes	Abundant from the southeastern panhandle to the Yukon River. Major runs in the Yukon, Susitna, and Copper River drainages. Spawning occurs from May through July. Fish hatch in fresh water, spend 3-7 years in the ocean, and then return to spawn in their natal streams. Chinook salmon are the most highly prized sport fish in Alaska.
Chum (dog) salmon	*Oncorhynchus keta*	X	X	X	Yes	Most abundant commercially harvested salmon species in the Arctic, northwestern, and Interior Alaska. Spawn in small side channels and other areas of large rivers where upwelling springs; young run to sea right after emerging from gravel. Important year-round source of fresh and dried fish for subsistence and personal use purposes in the Arctic, northwestern and Interior Alaska.
Sockeye (red) salmon	*Oncorhynchus nerka*		X	X	Yes	Occur in the North Pacific and Arctic oceans and associated freshwater systems. Spawn in rivers, streams, and upwelling areas along lake beaches after spending one to four years in the ocean. After hatching in winter, juvenile sockeye salmon may spend up to four years in fresh water before migrating to sea. One of the most important commercial and sport fisheries in the state and remain an important mainstay of many subsistence users.
Burbot	*Lota lota*	X	X	X	No	Occupy large clear and glacial rivers and many lakes throughout most of Alaska. Adults are voracious predators, feeding mostly on fish. Burbot spawn under the ice in late winter. The most popular fishing areas are the Yukon and Tanana rivers.

TABLE 5.6-1 Fish Species Inhabiting Waterbodies Crossed by the Proposed Project

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History [a, b, c]
		North Slope	Interior	Southcentral		
Ninespine stickleback	Pungitius pungitius	X	X	X	Yes	Widespread, occupying marine, brackish, and freshwaters. Prefers shallow vegetated areas in lakes, ponds and pools in slow streams; marine populations most often in marshes and estuaries near shore. Spawns in freshwater during summer months.
Threespine stickleback	Gasterosteus *aculeatus*	X		X	Yes	Occur primarily along the coastal regions of Alaska south of Nome in marine, brackish, and freshwaters. Anadromous and resident freshwater forms exist. Found in shallow vegetated areas of lakes, ponds, rivers and streams. Nests built on sandy bottom.

[a] BLM 2002.
[b] Truett and Johnson 2000.
[c] Mecklenburg et al. 2002.

TABLE 5.6-2 Stream Crossings Proposed by Hydroregion in the Proposed Project Area

	Arctic	Interior	Southcentral	Total Crossings
Anadromous Stream Crossings[a,b]	6	24	52	82
Stream Crossings with resident fish[c,d,e]	49	95	10	154
Total Stream Crossings	116	322	78	516

[a] Streams that have been nominated as anadromous were considered anadromous.
[b] Johnson and Blanche 2010, 2011a, 2011b, and 2011c.
[c] . Resident fish data is incomplete.
[d] ADF&G 2011b.
[e] BLM 2002.

A thorough freshwater fish inventory has not been conducted for the majority of the stream crossings along the proposed right-of-way (ROW) south of Livengood to the Cook Inlet. Existing resident fish information was utilized from stream sampling results along the Trans Alaska Pipeline System (TAPS) Corridor and the ADF&G Freshwater Fish Inventory (AFFI) (BLM 2002, ADF&G 2011b). The TAPS corridor coincides with the proposed ROW from Prudhoe Bay to Livengood. AFFI data was the only information available for the proposed ROW area south of Livengood to the Cook Inlet. These data are not complete and are intended only for planning purposes. The information that does exist for resident fish does not include temporal habitat use. Site specific hydrologic information such as water depth, water chemistry, and the presence of flowing water during the winter months are needed at each stream crossing. This information is required to determine the method and timing of construction by stream crossing in order to minimize impacts to the extent most practicable to fish and their habitat.

The AFFI information is not sufficient, and detailed studies would be required for specific sites intended for intensive uses (ADF&G 2011b). The AFFI represents the best available data for the proposed Project area south of Livengood. As noted above, each stream crossing in the proposed Project would require consultation with NOAA for EFH and will require an ADF&G fish habitat permit, which will include the necessary fish resource and hydro-geomorphic information to make a sound decision on crossing method and construction season.

Arctic Slope Region

The Sagavanirktok River is the only major river drainage along the proposed Project in the Arctic Slope region. The Sagavanirktok River is approximately 180 miles long and originates on the North Slope of the Brooks Range and flowing north to the Beaufort Sea near Prudhoe Bay. The Dalton Highway roughly parallels the river from Atigun Pass to Deadhorse. Six stream crossings were documented with anadromous fish present in the Arctic region of the proposed Project area (Table 5.6-4 and Appendix E). Dolly Varden and broad whitefish are the most common anadromous species known to occur in areas that will be crossed by streams in the Arctic region of the proposed Project area (Johnson and Blanche 2011a). The main channel of the Sagavanirktok River is considered critically sensitive between May to June, due to Arctic grayling spawn in tributaries. The main channel is also considered critically sensitive between

August through October when Dolly Varden migrate through the Sagavanirktok River and spawn in spring-fed tributaries (ADNR 2006). Arctic grayling and ninespine stickleback are the most widespread resident fish found in streams in Arctic Alaska (Truett and Johnson 2000).

Sport fishing pressure along the Sagavanirktok River drainage is low compared to subsistence fishing and sport fishing elsewhere in Alaska (Scanlon 2010). Sport fishermen in this region harvest Dolly Varden, Arctic grayling, burbot, and whitefish (ADF&G 2010). Most sport fisheries for Dolly Varden target overwintering populations in the fall as the fish return to freshwater or in the spring as they move toward the sea to feed (Scanlon 2010). No commercial fishing occurs in the Sagavanirktok River drainage (Scanlon 2010).

Most freshwater Arctic fish populations are limited by the availability of overwinter habitat (Truett and Johnson 2000). Lakes at least 6.5 feet deep provide fish with open water habitat throughout the winter and prevent eggs from freezing (Craig 1984, Truett and Johnson 2000). Although numerous smaller lakes occur in the vicinity of the proposed Project area on the North Slope, they are often too shallow (i.e., less than 6.5 feet deep) to support winter fish populations. However, if these shallow lakes are connected to a fish bearing stream or river, they will support fish during the summer months. Winter's onset is a period of environmental change that almost always results in migration, either within a given habitat, among habitats of the same system, or among systems (Reynolds 1997). Craig (1989) stated that the small amount of over-wintering habitat available could be the most important factor limiting population size and causing cyclical fluctuations in fish species abundance (Truett and Johnson 2000). Lake trout, Arctic char, Arctic grayling, Alaska blackfish, Northern pike, broad whitefish, round whitefish, Arctic whitefish, ninespine stickleback and burbot can be found in lakes deep enough to support overwintering fish (ADF&G 2010).

Interior Alaska

Major rivers along the proposed Project area in Interior Alaska include the Yukon and the Tanana Rivers. Sport fishing pressure is generally light throughout the region. Subsistence and commercial fishing are permissible in the Yukon and Tanana Rivers.

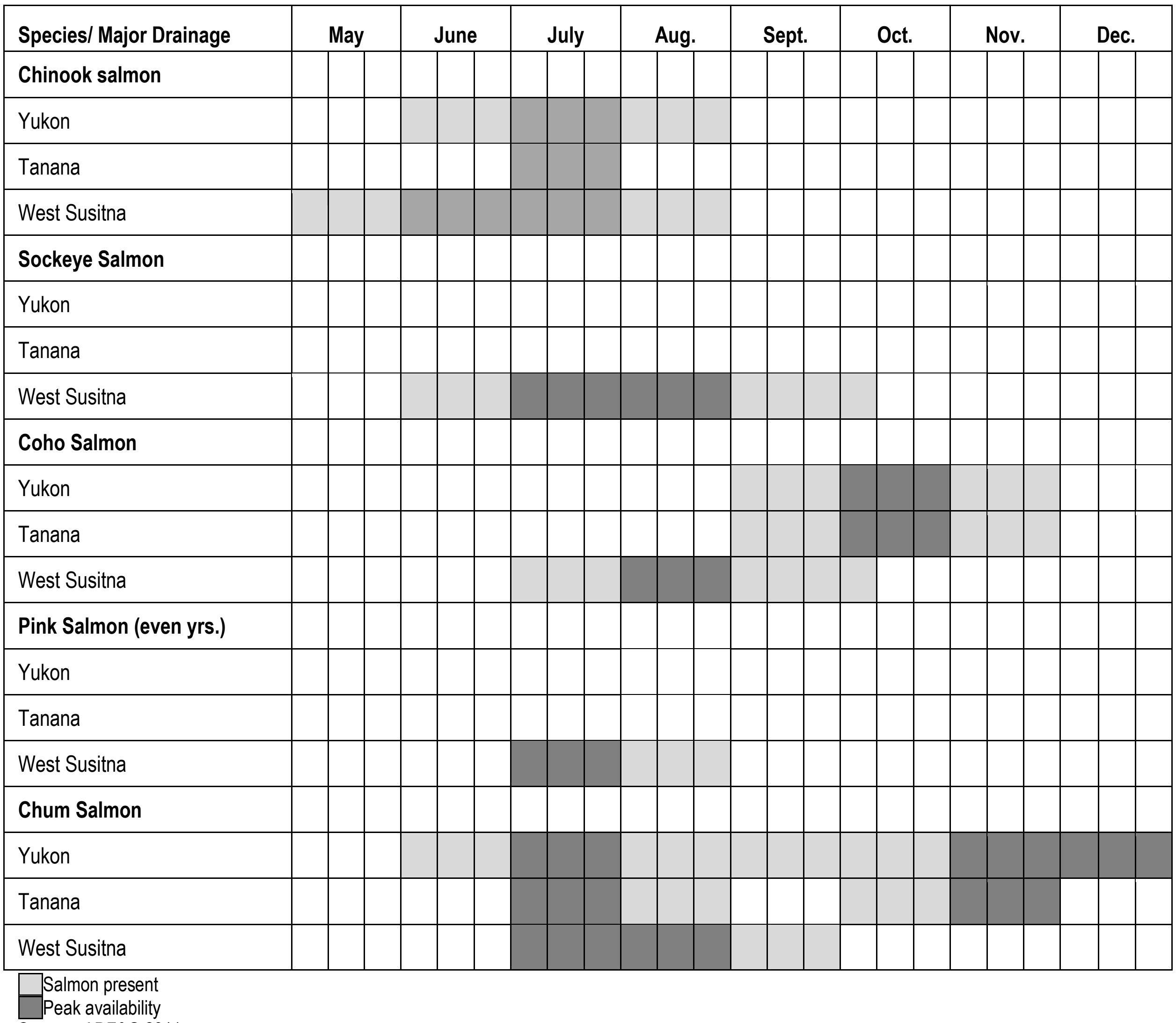
Anadromous fish are known to occur in 24 stream crossings within the proposed Project area in Interior Alaska (Table 5.6-2). The Yukon River and the South Fork of the Koyukuk River have the most anadromous fish species for this region (Johnson and Blanche 2011b).

The Yukon River

The Yukon River is the longest river in Alaska and it has one of the longest salmon runs in the world. Presently all populations of fish in the Yukon River drainage are wild and no stocking to enhance fish populations occurs in this area. Chinook, chum, and coho salmon are harvested in the subsistence, commercial, personal use, and sport fisheries along the Yukon River. The Yukon River chum salmon run consists of an earlier summer run and a later fall run. Run times for spawning salmon on the Yukon River occur from June to August for Chinook salmon, September to November for Coho salmon, and June to December for chum salmon (Table 5.6-3). Subsistence fishing has the highest priority among all uses of the resource in the

State of Alaska, and whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258). The villages along the Yukon River have historically and continue to rely on salmon for their cultural, subsistence, and commercial needs. Salmon are traditionally dried, smoked, and frozen for both human and sled dog consumption. Common methods of fishing on the Yukon River include set gill nets and fish wheels (Busher et al. 2009).

TABLE 5.6-3 Salmon Spawning Run Periods within Major Drainages of the Proposed Project Area



Source: ADF&G 2011a.

The proposed Project occurs within ADF&G Yukon District 5C. Subsistence harvest for this district averaged 1,862 Chinook salmon, 1,057 chum salmon, and 50 coho salmon annually from 2000 to 2009 (Dani Evenson, Pers. Comm. 2010). During the past decade, subsistence harvest was highest for Chinook salmon from 2002-2004 in this District (Dani Evenson, Pers. Comm. 2010).

Low returns in recent years caused the subsistence harvest of Chinook salmon on the Yukon to be restricted in 2008 and 2009. Since 1993, wide swings in productivity have occurred in the Yukon fall chum run. In 2001, only 176 chum salmon were harvested by subsistence users whereas in 2006, 5,918 chum salmon were harvested (Dani Evenson, Pers. Comm. 2010). In 2009, the fall chum salmon subsistence harvest was 1,024 fish for the Yukon District 5C (Dani Evenson, Pers. Comm. 2010). Important subsistence fisheries for whitefish and lamprey also occur in this area.

Commercial harvests in Yukon District 5 have historically been dominated by chum and more recently, by king salmon, with the commercial harvest of Coho salmon being mostly incidental to the fall chum salmon fish. In years with average returns and run timing, the first commercial fishing period usually occurs between July 1 and July 7 for the area of the Yukon River crossed by the proposed Project. The fall chum commercial fishing period typically occurs in mid-August. Between 2000 and 2009, an average of 151.3 Chinook salmon and 1010 fall chum salmon were commercially harvested annually from the Tanana River in Yukon River District 5C (Dani Evenson, Pers. Comm. 2010).

There has been high variability in the Chinook salmon run strength in the Yukon River during the past decade (JTC 2010). Commercial harvest of Chinook salmon was closed due to poor run strength during 2000, 2001, 2008, and 2009. Runs for commercially harvested Chinook salmon in District 5C were highest in 2006 with 481 fish more than tripling the 10 year annual average (Dani Evenson, Pers. Comm. 2010). Due to reduced abundance, Chinook salmon returning to the Yukon River is currently listed as a “Stock of Yield Concern” (JTC 2010).

In general, sport fish salmon in the Yukon River drainage is minor compared to commercial and subsistence harvests (Burr 2009). Pacific salmon (all species combined) comprise only about nine percent of the total sport harvest in this area (Burr 2009). Sport harvest in the Yukon River drainage is dominated by Arctic grayling, Northern pike, and sheefish. Fishing pressure is generally light and there are widespread opportunities throughout this region to fish for Arctic grayling, Dolly Varden, Northern pike, burbot and lake trout (Burr 2009). Broad whitefish and Bering cisco are also important fisheries in the Yukon River drainage.

Tanana River

The Tanana River drains an area of approximately 45,155 square miles and is the second largest tributary system that feeds the Yukon River. The main branch of the Tanana River is a glacial river flowing northwest for 570 miles to the Yukon River and formed by the confluence of the Chisana and Nabesna rivers near Tok and the Alaska-Canada border.

The proposed Project would cross the Tanana River within the Lower Tanana Management Area (LTMA) and would occur within ADF&G Yukon River District 6B. There are 18 fish species native to the Tanana River drainage. Chinook salmon, Coho salmon, Arctic grayling, burbot, lake trout, and Northern pike are the species most sought after by sport fishermen in this area (Brase 2009). Fish species present, but not often targeted by sport anglers, include chum salmon, Dolly Varden, sheefish, least cisco, humpback, broad, and round whitefish, longnose suckers, Alaska blackfish, lake chub, slimy sculpin, and Arctic lamprey (Brase 2009). In addition, although rainbow trout are not native to the Tanana River drainage, the ADF&G raises them in hatcheries and stocks many locations in the Tanana River drainage. Native hatchery raised Arctic char, coho salmon, Chinook salmon, and Arctic grayling are also stocked in selected waters of the Tanana River drainage (Brase 2009).

Commercial and subsistence harvest of Chinook, chum, and Coho salmon occurs along the Tanana River, with commercial and subsistence fishing periods typically opened concurrently. Run times for spawning salmon on the Tanana River occur in July for Chinook salmon, September to November for Coho salmon, and June to November for chum salmon (Table 5.6-3). Summer commercial fishing periods usually occur in late July and into August, depending on run strength and buyer capacity. The first fall season commercial chum salmon fishing period normally occurs in early to mid September. Between 2000 and 2009, an average of 421.6 Chinook salmon, 9,848.8 fall chum salmon, and 11,888.0 Coho salmon were commercially harvested annually from the Tanana River in Yukon River District 6B (Dani Evenson, Pers. Comm. 2010). Between 2000 and 2009, an average of 999.6 Chinook salmon, 9,170.3 chum salmon and 6,396.3 Coho salmon were harvested annually by subsistence users in Yukon River District 6B (Dani Evenson, Pers. Comm. 2010). Important subsistence fisheries for whitefish also occur in this area, although data for these fisheries are limited (Dani Evenson, Pers. Comm. 2010).

Sport fishing in the Tanana River drainage occurs throughout the year as angler's fish through the ice on stocked lakes and in the rivers for burbot and Northern pike. Rivers important for sport fishing in or near the proposed Project area include Chatanika and Nenana Rivers. In addition, the Minto Flats State Game Refuge occurs within the Tanana River drainage. This refuge was established in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of public uses within the area.

Southcentral Alaska

The Southcentral Alaska region of the proposed Project area is dominated by the Susitna River drainage system. More anadromous stream crossings occur along the proposed Project in the Southcentral region than in the Interior and Arctic regions combined (Table 5.6-2). A total of 52 stream crossings support anadromous fish species in this region (Table 5.6-2). Run times for spawning salmon on the Susitna River primarily occur from May to August for Chinook salmon, June to early October for sockeye salmon, July to early October for coho salmon, July to August on even years for pink salmon, and July to September for chum salmon (Table 5.6-3). Popular Chinook salmon sport fisheries within this area include Willow, Little Willow, Caswell, Sheep, Goose, Greys, and Montana creeks, and the Kashwitna River, all of which receive relatively high sport angling effort due to access from the Parks Highway. Several subsistence fisheries have been documented in the Susitna drainage (Tim Sundlov, Pers. Comm. 2012).

Susitna River

The Susitna River originates from glaciers of the Alaska and Talkeetna Mountain ranges and flows about 200 miles in a southerly direction before entering the Cook Inlet near Anchorage. Chinook salmon have been documented above Devils canyon (Tim Sundlov, Pers. Comm. 2012). However, the lower Susitna River drainage system supports extensive and diverse recreational fisheries for five species of Pacific salmon. The lower Susitna drainage area also has the most aggressive lake stocking program in the state, where more than 90 of the area lakes are stocked with rainbow trout, Arctic grayling, Arctic char, landlocked Coho and Chinook salmon (ADF&G 2011a). The two most sought-after salmon species are the Chinook and Coho salmon. Chinook spawning runs peak during June and July; sockeye runs peak in July and August; and Coho runs peak during August of each year (Table 5.6-3). Pink salmon are primarily dominant during even year runs, but are also present in odd years. Excellent fishing opportunities also occur for wild stocks of rainbow trout, Dolly Varden, Arctic grayling, and Northern pike (ADF&G 2011c). Limited sport fishing opportunities occur for burbot, Arctic char, and lake trout in nearby lakes.

No commercial or subsistence fisheries exist in the freshwaters of the Susitna River drainage. A freshwater eulachon (hooligan) Personal Use dip net fish exists in the Susitna River from April 1 through June 15. The proposed Project would parallel the Susitna River where this Personal Use fish occurs.

5.6.2 Environmental Consequences

5.6.2.1 No Action Alternative

Under the No Action Alternative the proposed Project would not be developed and therefore, no impacts would occur to fish resources.

5.6.2.2 Proposed Action

Preconstruction Activities

Water Withdrawals

Water withdrawn from permitted lakes would be used for ice road and pad development and for potable water use for temporary work camps. The ADF&G authorizes Title 16 permits required for projects that could potentially affect fish and their habitat. The ADNR authorizes Temporary Water Use Permits (TWUP), which are required to determine recommended water withdrawal limits from each water source. The permitting process regulates water withdrawal to prevent degradation of water quality during the winter months. The amount of water permitted for winter withdrawal (either in the form of water or ice chips) depends mainly on the fish species present, lake depth, and water volume in each lake. Water withdrawal rates and intake screen mesh size and dimensions for the pumps are determined by the different swimming abilities of various species and age classes of fish present at the water withdrawal site (ADF&G 2012b).

TABLE 5.6-4 Critical Time Periods for Anadromous and Resident Fish by Lifestage found in waters of the Arctic Coastal Plain

Species/Lifestage	Location	Stage Time Period											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dolly Varden, Arctic char, Whitefish, Inconnu, Arctic Grayling, and Burbot													
Spawning Area	At Crossing						C	C	C	C	C	C	
	Above Crossing						S	S	S	S	S	S	
	Below Crossing						C	C	C	C	C	C	
Incubating Eggs and Emergence - Alevins	At Crossing	C	C	C				C	C	C	C	C	C
	Above Crossing	NS	NS	NS				S		NS	NS	NS	NS
	Below Crossing	C	C	C				C		C	C	C	C
Fry / YOY	At Crossing			S	S	S	S	S	S	S			
	Above Crossing			NS	NS	NS	NS	NS	NS	NS			
	Below Crossing			S	S	S	S	S	S	S			
Juvenile Rearing (Age 0+, Age 1+, Age 2+)	At Crossing				S	S	S	S	S	S	S		
	Above Crossing				NS	NS	NS	NS	NS	NS	NS		
	Below Crossing				S	S	S	S	S	S	S		
Juvenile Migration / Outmigration (Age 0+, Age 1+, Age 2+)	At Crossing				S	S	S	S	S	S			
	Above Crossing				NS	NS	NS	NS	NS	NS			
	Below Crossing				S	S	S	S	S	S			
Adult Holding Areas	At Crossing						S	S	S	S	S	S	
	Above Crossing						NS	NS	NS	NS	NS	NS	
	Below Crossing						S	S	S	S	S	S	
Adult Migration	At Crossing						S	S	S	S	S	S	
	Above Crossing						S	S	S	S	S	S	
	Below Crossing						S	S	S	S	S	S	

C = Critical Sensitive
S = Sensitive
NS = Non-sensitive
YOY = Young of the Year
Source: ADF&G 2011b and 2012a.

Sensitive fish species are those species that are classified as having a reduced tolerance to low levels of dissolved oxygen concentrations in the waters that they are found versus non-sensitive fish species. If sensitive fish species are present, the withdrawal of water and ice chips is limited to 15 percent of the lake volume that is deeper than 7 feet of water depth. When only non-sensitive fish species are present, up to 30 percent of the water volume that is deeper than 5 feet of depth may be used. For non-fish bearing lakes and ponds, a maximum of 20 percent of the total lake volume is available for water withdrawal.

At least 975 million gallons of water would be required to support construction activities for the proposed Project (Section 5.2; Table 5.2-22). For Construction Spread 1, from the GCF to the Chandalar Shelf, approximately 279.2 million gallons of water would be required for construction and work pads, which minimize environmental affects to North Slope construction sites (Section 5.2; Table 5.2-22). Lake study results conducted by AGDC in 2010 were used to identify the maximum recommended water withdrawal limits. This was based on water volume and fish species present from all lakes sampled along the proposed Project area from the GCF to Galbraith Lake (Figure 5.6-1, Table 5.6-5, and Table 5.2-22). Potential water sources and water withdrawal requirements for construction activities for the proposed route south of Galbraith Lake have not been determined. Ice roads and pads would primarily be used in the Arctic Coastal Plain region, resulting in lower water demands for areas south of the Brooks Range. The AGDC would likely use similar water sources south of Galbraith Lake that was used for the TAPS construction, the details for which will be determined later in the process.

TABLE 5.6-5 Maximum Recommended Water Withdrawal Limits (Million Gallons) for Lakes Confirmed to Inhabit Fish along the Proposed ROW from the GCF to Galbraith Lake

Lake Name	Surface Area (acres)	Maximum Depth (feet)	Total Volume (MG)	Sensitive Fish Species Present	Non-Sensitive Fish Species Present	Maximum Recommended Water Withdrawal limits (MG)
DNR016	259.8	-7.75	399.4	None	Ninespine Stickleback	14.6
DNR029	56.5	-20.0	143.8	Arctic Grayling / Broad Whitefish		6.9
DNR030	17.5	-10.5	20.4	Arctic Grayling		0.11
DNR033	17.9	-9.5	30.1	Arctic Grayling		0.34
DNR034	8.0	-24.0	24.9	Arctic Char		1.6
DNR036	27.1	-44.0	155.1	Arctic Char / Slimy Sculpin		15.0
DNR038	19.9	-23.0	55.3	Arctic Grayling/Round Whitefish		2.6
DNR039	22.6	-64.0	177.2	Lake Trout / Arctic Grayling		19.3
DNR040	87.8	-55.0	825.9	Lake Trout / Arctic Grayling / Round Whitefish / Broad Whitefish		95.1

TABLE 5.6-5 Maximum Recommended Water Withdrawal Limits (Million Gallons) for Lakes Confirmed to Inhabit Fish along the Proposed ROW from the GCF to Galbraith Lake

Lake Name	Surface Area (acres)	Maximum Depth (feet)	Total Volume (MG)	Sensitive Fish Species Present	Non-Sensitive Fish Species Present	Maximum Recommended Water Withdrawal limits (MG)
DNR042	15.2	-27.0	66.2	Round Whitefish		5.1
DNR044	10.5	-43.0	71.6	Lake Trout / Arctic Grayling		7.5
DNR045	44.9	-26.0	146.1	Lake Trout / Arctic Grayling / Round Whitefish / Burbot / Slimy Sculpin		9.9
Galbraith Lake	NA	NA	NA	Lake Trout / Arctic Grayling / Round Whitefish / Burbot		NA

Source: AGDC 2011b, 2012b.

Fish species considered to be sensitive to dissolved oxygen concentrations in this area include Arctic grayling, Arctic char, lake trout, broad whitefish, round whitefish, burbot, and slimy sculpin (AGDC 2011b). Ninespine stickleback was the only non-sensitive fish species confirmed to be present in these lakes (AGDC 2011b). Table 5.6-5 identifies all lakes in which sensitive and non-sensitive fish species were found and includes the maximum recommended water withdrawal limits. Alternative construction techniques would be evaluated if sufficient water is not available. Supplemental site-specific fish data for lakes south of Galbraith Lake where water would be withdrawn are not yet available. Additional site-specific data for each lake would be required to meet ADF&G and ADNR permit requirements. Confirmed fish resources and water volume calculations from additional field studies will determine the maximum recommended water withdrawal limits.

Impacts to water quality from water withdrawals include decreased oxygen concentrations, increased organic matter, turbidity, and changes to pH (AGDC 2011b). To minimize impacts to fish resources, water would be withdrawn only from designated, permitted, surface-water sources with the capacity to supply the desired volumes without adverse effects on aquatic habitat and associated biota (particularly overwintering fish).

Potential impacts to fish, invertebrates, and fish habitat from winter water withdrawal include:

- Lower oxygen concentration levels in lakes from fluctuating water levels which can seriously stress or kill fishes (Cott et al. 2008). Fish are particularly susceptible to decreased oxygen levels from water withdrawals during winter months when lakes are covered by ice which limits the amount of available habitat for overwintering fishes compared with open water conditions (Cott et al. 2008). Maintaining openings in the ice to pump water would allow for increased oxygen exchange at the lake surface.
- Water level fluctuations can alter fish behavior, distribution, and growth (Cott et al. 2008). Incubating eggs exposed by lowered water levels may cause eggs to desiccate or freeze (Cott et al. 2008). Flow regulation can be especially influential on the natural dispersion of larval and juvenile fish to rearing areas. Water withdrawals

should consider the biology of the fish species present in each lake to ensure that fish are not adversely affected (Cott et al. 2008).

- Fish and invertebrates could be killed or injured through mechanical stress, entrainment in withdrawn waters, impingement on intake structures, or being frozen to ice road surfaces on discharge (National Academy of Sciences 2004). Permit stipulations would limit water withdrawals from fish-bearing water bodies and regulate intake screen sizes, which would minimize the potential for entrainment.

Ice Roads

Ice bridges could form and persist across rivers and streams from ice road construction methods and compaction from vehicle use. Ice bridges would melt slower than the surrounding ice; however, standard ice road mitigation includes slotting the ice at stream crossings and outlets before breakup to allow streams to flow as the snow pack melts, allowing fish passage. Potential impacts to fish and invertebrates from ice roads include the following:

- Altered fish movements due to delayed melting of bridging ice across the stream;
- Grounding of ice may occur at ice road crossings over streams resulting in flooding which could affect the riparian habitat, flow and habitat availability temporarily for fish;
- Upwelling areas in streams could be altered, which are preferred overwinter habitat for resident fish and locations for redds (incubating embryos); and
- Hydrologic alteration of the water body from water withdrawal for ice road development could affect sensitive invertebrate taxa.

Vessel Use

Thirty-five vessels would be required to ship materials (pipe, GCF modules and equipment) to the Port of Seward (POS) and six vessel shipments are required at West Dock for proposed Project construction. Vessel traffic through marine waters, especially the discharge of ballast waters at ports has the potential to spread aquatic invasive species and organisms which can spread diseases from one region to another. However, the ports currently used to export cargo to the POS and West Dock is the same ports proposed to ship materials for the proposed Project. No additional exposure of non-native aquatic invasive species would be expected to occur from proposed Project development. The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal shipping activities currently occurring at the POS and West Dock.

Ten Pacific salmon stocks listed under the ESA are included under Evolutionarily Significant Units (ESUs), and inhabit Alaskan marine waters at some part of their life history (feeding and migration). These include: five Chinook salmon stocks associated with the Columbia and Snake rivers and five steelhead stocks from the Columbia, Snake, and Willamette River drainages. These species move into marine waters to grow and mature, potentially moving large distances from their natal streams ranging throughout North Pacific waters, including the Gulf of Alaska, Cook Inlet, and Prince William Sound (NMFS 2011). It would be unlikely that Pacific west coast

ESU Chinook salmon and steelhead would migrate near the POS during vessel operations. Therefore, there would be no effect to ESA listed Chinook salmon or steelhead from construction or operation activities of the proposed Project.

Pipeline Right-of-Way

Construction

Construction of the right-of-way (ROW) would extend 737 miles and cross approximately 516 streams as noted above. Installation of the buried pipeline across fish-bearing streams during construction is likely to have the greatest potential effect to the fish resources from proposed Project development. All life stages of fish (anadromous and resident) could be affected by in-stream construction of the ROW, depending on the construction season, and the type of habitat impacted. As noted above, the EFH would be the most critical to avoid during construction. These areas may be identified in the field by upwelling or down welling of the hyphoreic zone, springs and seeps, water quality, habitat type (riffle, run, and pool), and traditional knowledge.

The ADF&G requires a permit under Alaska Statutes (AS), Title 16 Department of Fish and Game, which protects freshwater habitat in streams and rivers that support anadromous and resident fish. Each stream crossing would be individually permitted under AS 16.05.840-871 and work would be performed to comply under these permits. Each crossing would be evaluated for fish resources (life stage and habitat), and the proposed crossing technique would be developed cooperatively with the ADF&G to avoid adverse effects to EFH.

The 116 Arctic streams proposed for construction of the pipeline would occur during the winter months, and as a stipulation, all known overwinter fish habitat would be avoided because it is a limiting factor in the Arctic. As noted above, waterbodies with the exception of some of the lakes on the Arctic Coastal Plain, are primarily shallow (4 feet deep), which freeze to the ground in the winter. The fish resources in the Interior and Southcentral hydroregion drainages may receive more potential impacts from construction activities due to the proposed summer construction schedule versus the winter schedule in the Arctic region. Exposure to fish during the open water season would likely increase from in stream construction activities as more habitat is available for fish in the summer. EFH is also more abundant in the Interior and Southcentral regions than the Arctic.

The AGDC would construct each subsurface stream crossing in a manner and during a time period that would avoid or minimize potential fish impacts the most practicable. Figure 5.6-2 illustrates how the step by step process that the AGDC would follow to determine the type of crossing mode to be implemented at each stream crossing. The total length of time expected for in-stream pipeline construction to occur for each waterbody crossing is anticipated to be one to three days (AGDC 2011a).

Stream Crossing Methods

Stream crossings would be constructed using one of four methods: open-cut, open-cut isolation, horizontal directional drilling (HDD), or bridge crossings (Section 2.2.3.2). The degree of construction-related impacts to fish would depend on the type of crossing method used, the timing of construction, duration of in-stream activity, life stage and type of fish present and the mitigation measures implemented. Potential temporary impacts to fish resources that could occur during construction include in-stream habitat alteration (substrate, water depth, flow, large wood debris, water quality, sedimentation/turbidity) and changes to the channel profile. Permanent impacts may include: riparian habitat loss, which would result in increased water temperature; streambank erosion; reduced in-stream cover; reduced terrestrial insects as a food source for fish; increased predation; alteration of the hyporheic zone; and loss of spring and seeps.

Open-Cut Method

The open-cut method is the most common construction method used to install a pipeline under a stream channel. This method involves excavation of the pipeline trench across the waterbody, installation of a prefabricated segment of pipeline, and backfilling the trench with originally excavated soils and vegetative material (Section 2.2.3.2). Open-cut methods can be either dry or wet. Dry open-cut stream crossings occur when the entire stream width is seasonally dry (i.e., ephemeral stream) or frozen to the bottom (i.e., shallow streams during winter construction). The wet open-cut method is when the stream or river continues to flow through the construction zone. For all construction methods, the pipeline would be buried across these streams to a depth that provides a minimum of 5 feet of cover for all stream crossing modes except bridges, which would be aerially suspended (AGDC 2011a).

Open-cut crossings could impact fish resources by increasing sediment loads downstream during and shortly after the period of construction. Wet open-cut methods would most likely have the largest sediment loads and corresponding impacts to fish resources. The benefits of the open-cut method include low construction cost and short completion time. The primary disadvantages include increased sedimentation and erosion of the stream bank, loss of riparian vegetation, and greater alteration to channel morphology than what occurs with other stream crossing methods.

The dry open-cut method may reduce direct impacts to fish during construction compared to other methods, but fish habitat would be altered the same as noted above. Trenching, even under dry conditions, may reduce the productivity of streams by altering the habitat and substrate characteristics of the stream bank and channel (Fisheries and Oceans Canada 2007). Trenching may also alter stream hydrology by causing the proportion of surface and subsurface flows to shift (Fisheries and Oceans Canada 2007).

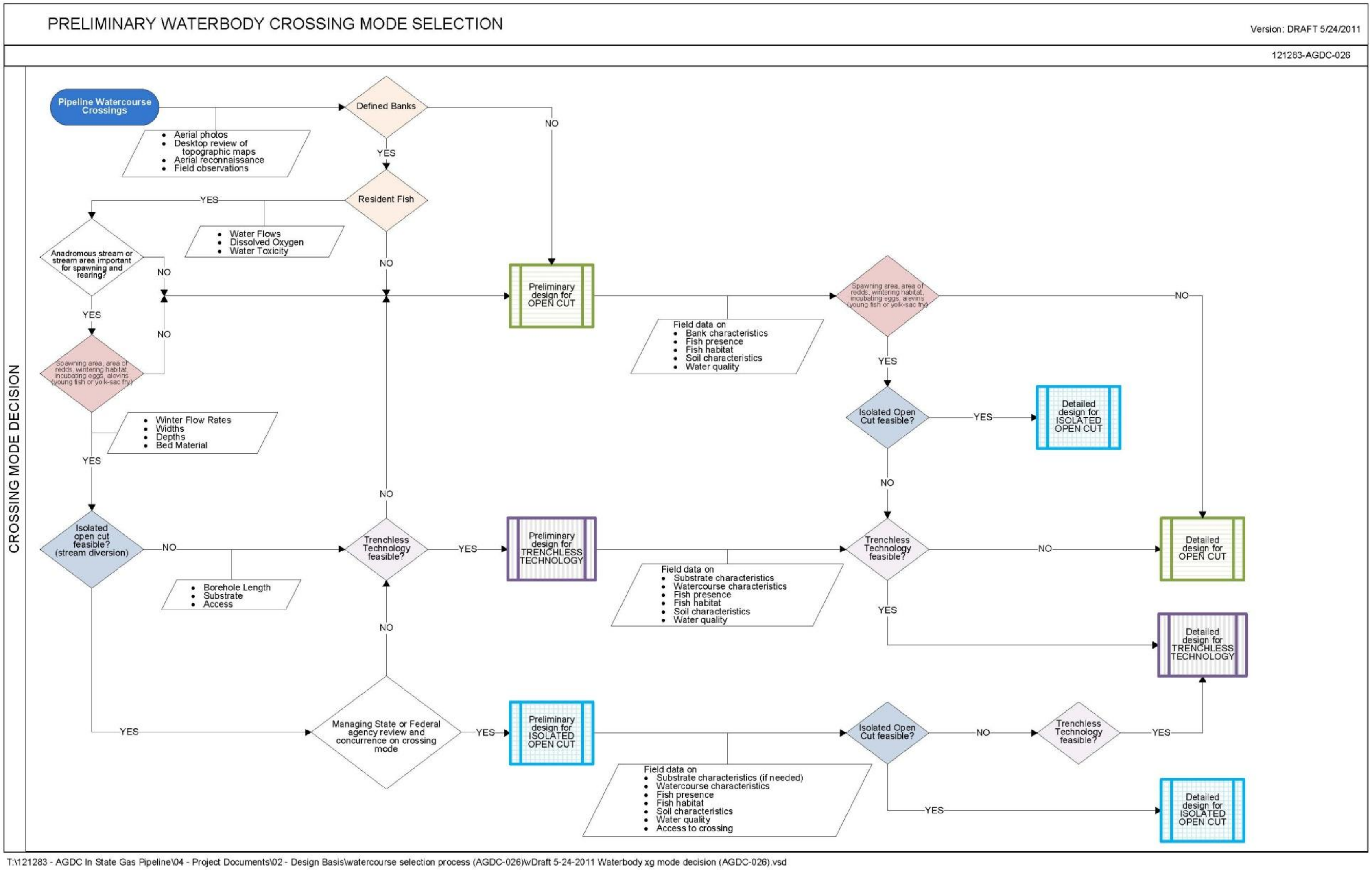


FIGURE 5.6-2 Preliminary Waterbody Crossing Mode Selection

Open-Cut Isolation Methods

Open-cut isolation crossing methods are used when the wet open-cut method are prohibited due to the presence of overwintering or spawning fish, or when stream flow conditions make the open-cut method impractical (AGDC 2011a). The open-cut isolation method isolates the water by placing a dam or flume across the stream and diverts the water around the pipeline (Section 2.2.3.2). The trench is then excavated, the pipe is installed, and the stream is stabilized after backfilling.

Open-cut isolation methods would have similar impacts on fish and fish habitat as the methods wet and dry open-cut methods noted above. However, the open-cut isolation method usually has less sediment yield during both summer and winter construction than a wet open-cut crossing method (Reid et al. 2004, Reid and Anderson 1999). However, poor containment of turbid water pumped from the isolated workspace, insufficient pump capacity, and the installation and removal of the dam could cause high releases of sediment (Reid et al. 2004, Reid and Anderson 1999). Additional problems with isolation methods could arise from several factors, including leakage around/underneath dam, dam failures, flume failures, insufficient pump storage, and inadequate maintenance (Reid et al. 2004). Some fish species or life stages may be more susceptible to injury when diverting water around the construction area of the drainage.

Blasting

Some open-cut and open-cut isolation crossings may require drilling or blasting to install the proposed Project pipeline. Streamside blasting could indirectly affect fish and aquatic invertebrates by causing increased sedimentation, noise, vibrations, and/or alteration of channel morphology (Wright and Hopky 1998). Blasting in or near waterbodies can cause direct negative impacts on fish populations due to shockwaves propagating through the water causing mortality (Wright and Hopky 1998). Shock waves of sufficient size and strength traveling through the water column (either from underwater blasts or from waves transmitted from on-shore blasts) can have a wide range of effects on fish. Larger fish may be startled by the waves, and smaller fish can be injured or killed when their internal swim bladder is ruptured. Small fish can also be stunned temporarily by shock waves making them more susceptible to predation (ADF&G 1991).

Blasting would occur when needed to fracture frozen soils or rock; however, a Blasting Control Plan would be developed to mitigate blasting effects in environmentally sensitive areas near fish habitat (AGDC 2011a). Blasting through deflagration techniques would be relatively harmless to fish, but detonation methods (e.g., TNT) produces much higher energy levels, which could injure or kill fish (ADF&G 1991). The AGDC would follow the ADF&G Blasting Standards (ADF&G 1991) to protect fish and redd (incubating embryos) habitat. A Fish Habitat permit may be required for any blasting operation that occurs either in, or near the banks of, a fish bearing waterbody (ADF&G 2012c). The permit would stipulate that:

> *Explosives shall not be detonated within, beneath or adjacent to any stream specified as being important for the spawning, rearing, or migration of*

anadromous fishes unless the detonation of the explosive produces an instantaneous pressure rise in the water body of no more than 2.7 psi and a peak particle velocity of no more than 0.5 inches per second, or unless the water body, including the substrate, is frozen.

Horizontal Directional Drilling Method

HDD is a trenchless crossing method that may be used to avoid direct impacts to waterbodies by directionally drilling beneath them. HDD involves installation of the pipeline beneath the ground surface by pulling the pipeline through a pre-drilled bore hole. HDD requires an entry and exit box that is placed on either side of the feature to be crossed. This method works best for large water bodies or in areas with exceptionally vulnerable ecosystems. The AGDC proposes to use trenchless methods (likely HDD) at 41 waterbody crossings (Section 2.2.3.2).

Impacts to fish resources from HDD could occur if drilling fluids used to lubricate, remove cuttings, and stabilize the bore hole are unintentionally released into surface waters due to site geological conditions or if drilling fluids are not properly contained or disposed (see 58 FR 15284). No synthetic or potentially toxic drilling fluid additives would be used for the proposed Project. Small quantities of drilling fluid could potentially be released into the aquatic environment if containment materials at entrance pit and receiving hole fail; however, this would be unlikely. Containment of drilling fluid in aquatic environments (wetlands) are often difficult because drilling fluid readily disperses in flowing water and quickly settles in standing water. Suspended bentonite may reduce viability of fish and aquatic invertebrates by inhibiting respiration due to fouled gills during the short-term. If benthic invertebrates, larval fish, or incubating eggs are covered, they may suffocate due to fouled gills and/or lack of oxygen. The AGDC has listed several mitigation techniques that will be used during HDD activities of proposed project development to prevent potential impacts to fish resources. See the mitigation section (Section 5.23.2.6) for proposed HDD activities.

Bridge Crossing Method

Four river crossings are proposed that would result in the aerial placement of the pipeline in association with three existing bridges, in addition to potentially utilizing the existing E.L. Patton Yukon River Bridge Option (see section on Yukon River Crossing Options below). These bridges would be utilized for pipeline placement at the Chulitna River, Coal Creek, and Hurricane River (Section 2.2.3.2).

Bridge crossings would be designed to provide natural hydro-geomorphic processes within the stream or river flood plain, promote natural sediment transport, allow natural debris movement, and maintain functional longitudinal continuity and connectivity of the watershed. No footings or piles would be placed below the ordinary high-water mark for bridge construction at any stream crossing.

Hydrostatic Testing

Upon completion of construction activities, an estimated 79.4 million gallons of water would be required for hydrostatic testing (Table 5.2-22) for the mainline pipeline to confirm that it meets design criteria and is leak-free (AGDC 2011a). Water sources have not been identified and thus impacts to fish cannot be fully analyzed. However, water for hydrostatic testing would be withdrawn only from designated, permitted, surface-water sources with the capacity to supply the desired volumes without adverse affects on aquatic habitat and associated biota (particularly overwintering fish). The AGDC would also assure water withdrawal activities use appropriately-sized fish screens and other state and federal guidelines for fish protection. The ADF&G dictates a maximum mesh opening size for the screens to prevent fish from entering the pump and a maximum approach velocity for water at the screen's surface to prevent fish from being entrained or impinged on the screen (ADF&G 2012b). Hydrostatic testing would most likely be completed using untreated, heated water approximately 36°F to 38°F under most conditions. In winter, water would be freeze-protected, or compressed air would be used to test the pipe. Any freeze point depressant used would be returned to the supplier or disposed of in a waste disposal well or according to applicable government regulations. Freeze depressants would not be discharged into streams.

Discharge locations have not been identified and thus impacts to fish cannot be fully determined. Discharges would comply with Alaska Pollutant Discharge Elimination System (APDES) procedure and permit requirements. Test water releases would be confined to designated, permitted upland locations and would be diverted to settling basins as necessary to comply with discharge permit limitations. Personnel would be trained in proper use of freeze depressant during hydrostatic testing and would implement hydrostatic testing in a manner that would not allow freeze depressants to be discharged to any streams.

Operation and Maintenance

Maintenance of the ROW

During operation of the proposed Project, vegetation would be maintained along the ROW to a non-forested state. Vegetation maintenance and control may be accomplished through mechanical methods. Maintenance of the ROW would include mowing the riparian (vegetation that grows along river banks and streams). Riparian vegetation has many crucial functions in fluvial systems. The primary functions include: promoting bank stability, maintaining water quality, providing structure and food for fish and other aquatic organisms, water temperature control, flood control, and providing habitat (cover) for fish and wildlife (STB 2011, Brown et al. 2002). The viability of the stream at crossing locations would depend on the level of erosion that may occur from regular vegetation maintenance of the ROW or in-stream construction effects. This issue would be addressed in an Erosion and Sediment Control Plan. The AGDC would also develop a non-native invasive plant Prevention (NIP) Plan to address procedures to reduce or eliminate the spread of non-native invasive plants into the riparian area prior to proposed Project construction. For more information on vegetation control impacts and mitigation, refer to Section 5.3 (Vegetation).

Mowing of the permanent ROW may allow motorized access of all terrain vehicles (ATVs) to anadromous streams that were previously inaccessible. This could increase harvest pressure on fisheries populations if not regulated appropriately. ATVs used to cross anadromous streams could do substantial damage to in-stream habitat. This could include altered substrate, increased turbidity, streambank erosion, rutting and altering stream discharge at crossing locations, which could reduce productivity of fish species. The proposed Project would be collocated with existing ROWs (highways, TAPS ROW, and utility lines) the majority of it length. As a result, additional access to anadromous streams beyond what currently exists would be minimal.

Project Segments

Proposed stream crossing methods and timing of construction of 516 streams are provided in Appendix E and summarized in Table 5.6-6. Eighty-two stream crossings are known to contain anadromous fish (Table 5.6.6). One hundred and fifty-four stream crossings are known to contain resident fish (Table 5.6-6). The 516 waterbodies would be crossed using the following methods: 471 waterbodies via open-cut methods (open-cut and open-cut isolation); 41 waterbodies via HDD; and 4 waterbodies via new or existing bridges (Table 5.6-6). The AGDC has not identified which waterbodies would be crossed via open-cut or open-cut isolation crossing methods. A summary of construction crossing method and timing for all stream crossings containing anadromous fish is presented in Table 5.6-7.

TABLE 5.6-6 Stream Crossing Methods by Segment

Segment	Open-Cut	HDD	Bridge	Total Crossings	Anadromous Streams[a,b]	Resident Fish Streams[c,d,e]
GCF to MP 540	388	11(12)[f]	1(0)[f]	400	29 [b]	142
MP 540 to MP 555	6	0	0	6	0 [b]	1
MP 555 to End	57	30	3	90	53 [b]	11
Fairbanks Lateral	20	0	0	20	0[b]	0
Total	471	41	4	516	82	154

[a] Streams that have been nominated as anadromous were considered anadromous.
[b] Johnson and Blanche 2010, 2011a, 2011b, and 2011c.
[c] Resident fish data is incomplete
[d] ADF&G 2011b.
[e] BLM 2002.
[f] Yukon River will either be crossed with a bridge or HDD.

TABLE 5.6-7 Anadromous* Stream Crossing Construction Method by Segment[a,b]

Segment	Open-Cut		Horizontal Directional Drill		Bridge		Total
	Summer	Winter	Summer	Winter	Summer	Winter	
GCF to MP 540	2	18	0	8(9)[c]	0	1(0) [c]	29
MP 540 to MP 555	0	0	0	0	0	0	0
MP 555 to End	4	21	3	23	0	2	53
Fairbanks Lateral	0	0	0	0	0	0	0
Total	6	39	3	31	0	3	82

[a] Streams that have been nominated as anadromous were considered anadromous
[b] Johnson and Blanche 2010, 2011a, 2011b, and 2011c.
[c] Yukon River will either be crossed with a bridge or HDD

GCF to MP 540

Construction

The majority of the stream crossings (400) would occur between the GCF and MP 540. A total of 388 stream crossings would be open-cut and 11 would be constructed using the HDD method (Table 5.6-6). The Yukon River would be crossed with a new bridge, via the existing bridge, or by using the HDD method. Twenty-nine of the stream crossings are anadromous (Appendix E, Table 5.6-7). Two anadromous stream crossings would be constructed during the summer months using open-cut methods (Table 5.6-7). All other stream crossings containing anadromous fish would be constructed during the winter months (Table 5.6-7).

Resident fish are known to occur at 142 stream crossings in this segment (Appendix E and Table 5.6-8). Overwintering fish and their habitat are of particular concern in this region. A Title 16 permit is required from the ADF&G for construction activities in known fish overwintering areas. Construction activities in known overwintering areas for fish typically require activities to be conducted during open-water seasons. Water withdrawals in fish overwintering areas require a Title 16 permit from the ADF&G and a Temporary Water Use Permit (TWUP) from the ADNR. Refer to the Section on Water Withdrawals for a detailed description of potential water withdrawal impacts to overwintering fish.

Operations

Impacts to fish resources from operations and maintenance of the ROW from the GCF to MP 540 would be the same as what is noted above under mainline pipeline operations and maintenance.

TABLE 5.6-8 Resident Stream Crossing Construction Method by Segment[a,b,c]

Segment	Open-Cut		Horizontal Directional Drill		Bridge		Total
	Summer	Winter	Summer	Winter	Summer	Winter	
GCF to MP 540	29	107	0	5(6)[d]	0	1(0)[d]	142
MP 540 to MP 555	1	0	0	0	0	0	1
MP 555 to End	1	6	0	4	0	0	11
Fairbanks Lateral	0	0	0	0	0	0	0
Total	31	113	0	9	0	1	154

[a] Resident fish data is incomplete
[b] ADF&G 2011b.
[c] BLM 2002.
[d] Yukon River will either be crossed with a bridge or HDD

Yukon River Crossing Options

Construction

The Project proposes to cross the Yukon River in one of three ways: a suspension bridge to be constructed (the Applicant's Preferred Option), the existing highway bridge (Option 2), or via HDD (Option 3) as noted above.

The Applicant's Preferred Option

Impacts to fish resources from development of the Applicant's Preferred Option could include temporary large vessel use in the Yukon River to construct the suspension bridge. The potential for contamination could occur due to oil and fuel leaks from vessels and cranes. These impacts would not likely adversely impact water quality in the Yukon River. No permanent structures such as footings would be placed below the ordinary high water mark, which would result in minimal impacts from constructing a suspension bridge. Removal of riparian vegetation on either side of the River bank could contribute to minimal erosion that could increase sedimentation temporarily in the Yukon River. This would be unlikely to create an adverse impact to fish due to the existing water conditions of the Yukon River.

Option 2

This option includes placing the pipeline on a hanger pipe under the existing Yukon Patton Bridge. Potential impacts from construction would be negligible since there would be no surface water disturbance to the Yukon River. This option would use existing disturbed areas on either side of the River bank for equipment access to the Yukon River Bridge.

Option 3

No adverse effects to fish resources would be expected using the HDD method because there would be no in-stream construction. An unlikely but potential impact to fish resources from HDD activities was noted above under the discussion on HDD method. Removal of riparian vegetation on either side of the River bank where HDD construction would occur could contribute to erosion on the riverbank.

Operations

Impacts from operations and maintenance of the ROW on either side of the Yukon River would include maintenance of the ROW by mowing the vegetation to a non-forested state as noted above. Impacts to fish would be the same as noted above under mainline pipeline operations and maintenance.

Fairbanks Lateral

Construction

The Fairbanks Lateral would diverge from the proposed mainline at approximate MP 458 (MP FL 0.0) and extend through the Yukon-Koyukuk Census Area and Fairbanks North Star Borough, crossing 20 streams along its route (Table 5.6-6). The stream crossings along the Fairbanks Lateral have not been confirmed to contain anadromous or resident fish (Tables 5.6-7 and 5.6-8). All crossings are proposed to be constructed using open-cut methods during the summer months (Appendix E, Table 5.6-6). Impacts to fish from open-cut methods are listed previously in Section 5.6.2.2. Upon completion of construction activities, an estimated additional 1.03 million gallons of water would be needed for hydrostatic testing for the Fairbanks Lateral (Table 5.2-22) to confirm that the pipeline meets design criteria and is leak-free (AGDC 2011a).

Operations

Impacts to fish resources noted above from operations and maintenance of the ROW would include maintenance of the ROW by mowing the vegetation to a non-forested state. Impacts to fish resources include effects from riparian habitat removal as noted above.

<u>MP 540 to MP 555</u>

Construction

Six streams would be constructed during the summer by open-cut methods between MP 540 and MP 555 (Table 5.6-6). None of these streams have been confirmed to contain anadromous fish (Table 5.6-7), but one crossing has been confirmed to contain resident fish (Table 5.6-8). Additional fish sampling may be required in this segment of the proposed Project to confirm fish species presence and their life stage.

Operations

Impacts from operations and maintenance of the ROW would include the same impacts to fish resources as noted above.

<u>MP 555 to End</u>

Construction

Ninety streams would be crossed between MP 555 and the Cook Inlet NGLEP Facility. A total of 53 streams in this segment have been confirmed to contain anadromous fish (Table 5.6-6, Table 5.6-7). Twenty-five of these anadromous fish-bearing streams would be constructed using open-cut methods, 26 would use HDD methods, and two stream crossings would use existing bridges (Table 5.6-6, Appendix E). Most crossings containing anadromous fish would be constructed during the winter months, although four open-cut crossings and three HDD crossings are proposed to be conducted during the summer months. Eleven stream crossings are known to contain resident fish; seven of these streams would be crossed using open-cut methods and four by HDD (Appendix E, Table 5.6-8). Construction would occur during the winter months at ten of the stream crossings known to contain resident fish (Table 5.6-8). All stream crossings would be permitted to determine the appropriate method to reduce impacts to fish and fish habitat.

Operations

Impacts from operations and maintenance of the ROW would include mowing the vegetation to a non-forested state. Impacts to fish would be the same as what is noted above under mainline pipeline operations and maintenance.

Aboveground Facilities

Construction

Minimal direct impacts to fish would be expected from construction of aboveground facilities because they would not be constructed over or directly adjacent to waterbodies. Contaminants from runoff could leach into neighboring drainages and alter water quality; however, this would be minimal and localized due to strict spill prevention rules and regulations on work pads. Aboveground facilities would be constructed according to site-specific requirements and waste disposal would be performed in accordance with appropriate regulations and permits. Fuel storage, equipment refueling, and equipment maintenance operations would be located at least 100 feet from surface waters (AGDC 2011a).

Operations

Contaminants from gravel pad runoff could leach into neighboring drainages, altering water quality over time from operations and maintenance at facilities. Facilities on the North Slope use containment placed under vehicles to mitigate for contaminant exposure to the surrounding environment. Regular water withdrawal for facility use (GCF) from waterbodies that hold fish in the Arctic Coastal Plain may indirectly be impacted by proposed Project development. The water volumes withdrawn would be permitted to protect fish and their habitat and therefore, impacts would be unlikely to adversely affect fish resources.

Support Facilities

Construction

Support facilities would not be built over waterbodies; therefore, minimal impacts are expected to occur to fish resources. Contaminants from runoff could leach into neighboring drainages and alter water quality; however, this would be a negligible impact. Support facilities would be constructed according to site-specific requirements and waste disposal would be performed in accordance with appropriate regulations and permits. Fuel storage, equipment refueling, and equipment maintenance operations would be located at least 100 feet from surface waters.

Operations

Contaminants from runoff could leach into neighboring drainages, altering water quality over time from operations and maintenance at facilities. These impacts would be negligible to fish resources.

Access Roads

Construction

Nineteen streams would be crossed by new roads developed to access aboveground and support facilities. Five of the stream crossings would be new permanent roads and two would be new temporary roads. The number of new permanent access roads would be minimized by winter construction using ice roads and existing roads whenever possible. No new access roads to aboveground facilities that cross streams have been confirmed containing anadromous fish. Resident fish data are known to occur at 2 of the 19 streams crossed by access roads

(ST_108 and ST_114), but for many of these streams, fish data is not available. A Title 16 Fish Habitat Permit would be required for roads crossing fish-bearing streams.

The construction methods, timing, and design of new access roads across streams have not been developed. New access roads would require bridges or culverts to cross streams, which would result in long-term habitat alteration for fish. During road construction, in-stream habitat would be temporarily lost from water diversion to facilitate installation of culverts. Culvert installation could cause the loss of rearing, foraging, and spawning habitat in that reach of the stream. Implementing stream simulation culverts under all roads in tributary streams would alleviate many impacts to fish from geomorphologic alteration. Stream simulation culverts replicate the geomorphology of the stream by maintaining stream width, slope, velocity, channel structure, hydraulic conditions, and bed composition. Stream simulation culverts are limited in use because they are only applicable for small (narrow) streams. Bridge placement would be the preferred crossing structure when considering fish passage, habitat, and longevity. Free spanning bridges that cross moderate sized streams (second order) can be built to keep all structures (piles) out of the stream above the ordinary high water mark. In-stream impacts to fish and their habitat from bridge construction would be minimal and temporary. Long term impacts from bridge placement would include a loss of riparian vegetation at the bridge crossing and sedimentation from road use. Dust and gravel could be deposited in the stream channel on either side of the bridge. Run off could potentially bring contaminants from the road, affecting water quality in the stream. Bridge construction would not adversely affect fish populations.

Operations

Impacts to streams from access road development would be permanent and include dust deposition, which may alter water quality in the stream. Contaminants on roads from vehicle leakage may runoff into drainages also affecting water quality. Bridges and culverts as noted below would have additional impacts. Providing access for humans to utilize streams or reaches previously inaccessible could potentially increase fishing pressure in local streams. Roads also require a buffer of vegetation to be cleared, which would increase riparian vegetation removal along waterways near roads.

5.6.2.3 Denali National Park Route Variation

Construction

The Denali National Park Route Variation would have two stream crossings across the Nenana River. The Nenana River is considered an anadromous stream containing chum, Coho, and Chinook salmon. These crossings would include HDD and utilize the existing pedestrian foot bridge. The impacts to fish resources anticipated under this route variation are similar in magnitude and duration to those described in Section 5.6.2.2 for HDD and bridge crossings. Pipeline construction would result in riparian habitat alteration at stream crossings.

The mainline route from MP 540 to MP 555 has six stream crossings that are proposed to all be constructed via open-cut methods. The stream crossings along the mainline route have not been confirmed for the presence of anadromous species (Table 5.6-9). Impacts to fish resources would be similar to impacts noted above for open cut methods and would be dependent on the fish species present, life history and habitat use confirmed, in association with the timing of construction. Each crossing would be evaluated for fish resources, and the proposed crossing technique would be developed cooperatively with the ADF&G to avoid adverse effects to fish and their habitat (AGDC 2011a).

TABLE 5.6-9 Comparison of the Denali National Park Route Variation to the Mainline Route (MP 540 – MP 555)

Description	MP 540 – MP 555	Denali National Park Route Variation
Total Number of Stream Crossings	6	2
Anadromous Streams	unk	2
Resident Fish Streams	1	0

unk = unknown value

Operations

Vegetation maintenance of the ROW in the Denali National Park Route Variation would likely reduce the riparian habitat function along the stream crossing where the HDD activity would occur on the Nenana River. Utilizing the existing pedestrian bridge would not contribute any additional impacts during the operations of the proposed Project. Impacts would be negligible at the two crossings on the Nenana River for proposed Project operations.

The potential impacts noted above under the mainline pipeline facilities operations and maintenance would apply to the mainline route between MP 540 and MP 555. The viability of the stream at each of the six crossing locations would depend on the level of erosion that could occur from regular vegetation maintenance (mowing) of the ROW or residual in-stream impacts from construction activities. Stream bank erosion issues on fish and their habitat and regular maintenance of the ROW would be addressed in an Erosion and Sediment Control Plan.

Stream Crossing Impacts to Fish Resources

Changes to the Existing Thermal Regime

Maintaining the existing thermal regime of the waterbody is an important factor in limiting impacts to fish resources. A chilled buried pipeline may reduce the water temperature and flow in the stream creating ice damming on stream beds or form aufeis (thick layers of ice by successive freezing of stream overflow). This could result in a reduction of water flow downstream, or divert water outside of existing stream channels (AGDC 2011a). This altered environment for fish resources may affect behavior, survival, and productivity. Changes in the water temperature, and sediment composition of the hyporheic zone could cause a delay in hatching or direct mortality of embryos.

The pipeline would be buried to a depth that provides a minimum of five feet of cover for all streams (AGDC 2011a), and would be maintained at an ambient temperature as much as practicable. The pipeline would be operated at an ambient temperature closely approaching seasonal temperatures of the surrounding ground at the extent most practicable (AGDC 2011a).

Pipeline temperatures would be maintained below freezing temperatures in permafrost terrains and above freezing temperatures in thawed ground settings to prevent frost bulbs from forming around the pipe. Frost bulbs could lead to frost heave displacement of the pipeline or adverse hydraulic impacts on drainages crossed by the pipeline (AGDC 2011a). Engineering controls such as insulation and non-frost susceptible fill would be used to control the thermal signature of the pipeline to minimize effects on the existing thermal regime of the surrounding soils.

Direct Mortality

Direct mortality could occur to fish and embryos from excavation in the stream bed. Eggs and fry may be impacted at the construction site or downstream where increased sedimentation may reduce viability by causing gill irritation and behavioral modifications of fish and/or smother eggs (Reid et al. 2004). In addition, water diversions and temporary dewatering during construction may cause desiccation or freezing of developing eggs and pre-emergent fry. Potential fuel or hazardous material spills that occur during construction may also lead to direct mortality.

Barriers to Fish Movement

Construction-related activities could temporarily impede fish passage. Open-cut methods that require water diversions during the open-water construction period could create temporary physical barriers to fish passage or alter stream flows sufficiently. This could create either high or low water flows that prevent fish movements to rearing or spawning habitats. Juvenile salmonids are particularly dependent upon connectivity between tributaries and mainstem channel habitats (STB 2011, Bramblett et al. 2002). Spawning fish that are unable to reach optimal spawning habitat may be required to use alternative suboptimal spawning habitat, which could result in reduced survival of eggs, larvae, and juvenile fish (STB 2011). The likelihood of these impacts occurring would be minimal because the AGDC anticipates that in-water work would be complete between 1 to 3 days from initiation (Section 2.2.3.2). As a result, this period would not likely cause a substantial barrier for spawning, rearing, or migrating fish.

In-stream and Riparian Habitat Loss and/or Alteration

Fish habitat at the crossing location could be altered directly through excavation and backfilling of the pipeline trench changing substrate and stream bank conditions and removing riparian vegetation. Changes in habitat could result in a variety of impacts to fish, including direct mortality and changes in population size and structure, reproduction, and growth rate (BLM 2002). Riparian vegetation is extremely important for fish as noted above (STB 2011, Brown et al. 2002). The roots of riparian trees and shrubs prevent erosion by holding stream banks in place as well as trapping sediment and pollutants which help maintain water quality. During high stream flow periods, riparian vegetation, and woody debris slows and dissipates flood waters, which help to prevent or minimize erosion that can damage fish spawning areas and aquatic invertebrate habitats. Loss of riparian vegetation also reduces shading which can cause increased water temperature, reduced dissolved oxygen, reduced nutrient input, and increased predation of certain fish species due to reduced cover (STB 2011, Brown et al. 2002). Loss of riparian vegetation and disturbance to the bank and substrate can also alter benthic communities, changing prey availability for fish (Brown et al. 2002). As logs and woody debris land in the stream, they provide fish habitat by forming cover and slow water velocity areas for juveniles as refuge.

Degradation of Water Quality

Construction activities (excavation, clearing vegetation and grading) and access road development would expose soil to erosion processes, including wind, rain, and stream flow. Erosion causes increased sedimentation and turbidity which can degrade water quality, reduce fish habitat quality and fish productivity (Waters 1995). Impacts from increased sedimentation on fish include decreases in fish feeding efficiency, reduced levels of invertebrate (prey) species, smothering of incubating eggs, and decreases in fish spawning success (Reid and Anderson 1999). Due to their relative immobility, egg and larval life stages may be at greatest risk to be negatively affected by increases in suspended sediment concentration and sediment deposition (Reid and Anderson 1999). Although most fish populations can withstand short-term changes in turbidity and sedimentation, long-term adverse impacts can occur if sediment loads are extremely high or occur for extended periods of time (BLM 2002).

Pollutants could also potentially be introduced into waterbodies during construction. Fuel leaks during construction would reduce water quality, potentially resulting in toxic effects to fish and aquatic invertebrates. Spills and leaks could enter the water either directly from in-stream equipment or indirectly from runoff from adjacent road beds.

Alteration of Stream Hydrology

The hyporheic zone is the region beneath a stream bed where there is mixing of shallow groundwater and surface water. Hyporheic flow and groundwater upwelling (springs) are important for developing salmon eggs (STB 2011, Brown and Mackay 1995, Baxter and McPhail 1999). Construction activities may cause changes in flow patterns of the hyporheic zone by dislodging fine sediments that can clog interstitial spaces or compact substrates (STB 2011, Sear 1995, Huggenberger et al. 1998). As noted above, stream hydrology may also be altered by ice bridges

Introduction of Non-native Species

Introduced non-native species compete for food and space with native species and can transmit diseases (e.g., whirling disease [*Myxobolus cerebralis*]), that could adversely impact fish and sensitive life stages. Invasive aquatic plant species can be introduced into waterways and wetlands and spread by improperly cleaned vehicles and equipment operating in water, stream channel, or wetlands (Cowie and Robinson 2003, Fuller 2003). Alaska has had relatively few problems with invasive, non-native aquatic plants in the past. However, invasive aquatic plants are increasingly posing a threat to native aquatic communities in Alaska (PSU 2009). Actions taken to detect and prevent the introduction and spread of invasive aquatic plants in Alaska are needed to avoid the environmental and economic harm invasive plants have caused in other parts of the United States (PSU 2009). Riparian and aquatic invasive species that are a concern for freshwater streams in Alaska include, but are not limited to, Canadian waterweed (*Elodea canadensis*), didymo (*Didymosphenia geminata*), white sweetclover (*Melilotus alba*), and reed canarygrass (*Phalaris arundinacea*). If heavy equipment is being shipped to Alaska from the continental United States, other invasive species such as hydrilla (*Hydrilla verticillata)*, Eurasian watermilfoil (*Myriophyllum spicatum*), and New Zealand mudsnails (*Potamopyrgus antipodarum*) are also of concern. See the AGDC mitigation measures proposed to reduce adverse impacts to fish resources (Section 5.23.7).

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5.7 MARINE MAMMALS

This section discusses the marine mammals that are not listed as endangered, threatened or candidate species under the Endangered Species Act (ESA) of 1973, that may occur within or adjacent to the proposed Project areas. There are three Project areas proposed for vessel activity for Project construction: the Port of Seward, Port of Anchorage, and West Dock that will be discussed in detail below. The ESA-listed and candidate species are included in Section 5.8, Threatened and Endangered Species (T&E).

All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972 as amended. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The National Marine Fisheries Service (NMFS) has regulatory authority for all marine mammals relevant to the proposed Project with the exception of the sea otter, Pacific walrus, and the polar bear, which are under the U.S. Fish and Wildlife Service's (USFWS) responsibility.

Marine mammals that are listed as a strategic stock are defined by the MMPA:

- For which the level of direct human-caused mortality exceeds the potential biological removal level;
- Which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future, or
- Which is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.

The affected environment, species descriptions by proposed Project area and environmental consequences of the proposed Project are discussed in detail below.

5.7.1 Affected Environment

The proposed Project area includes the temporary use of up to three Alaska based port sites for the construction period (2 years) of the proposed Project. The proposed Project areas in the marine environment include the areas expected for vessel use. The primary ports include the West Dock Port in the Northern Project area at Prudhoe Bay, and the Port of Seward (POS) in Resurrection Bay in Southcentral Alaska. The Port of Anchorage (POA) in Cook Inlet could be used to supplement vessel traffic with the POS (Figures 5.7-1 to 5.7-4).

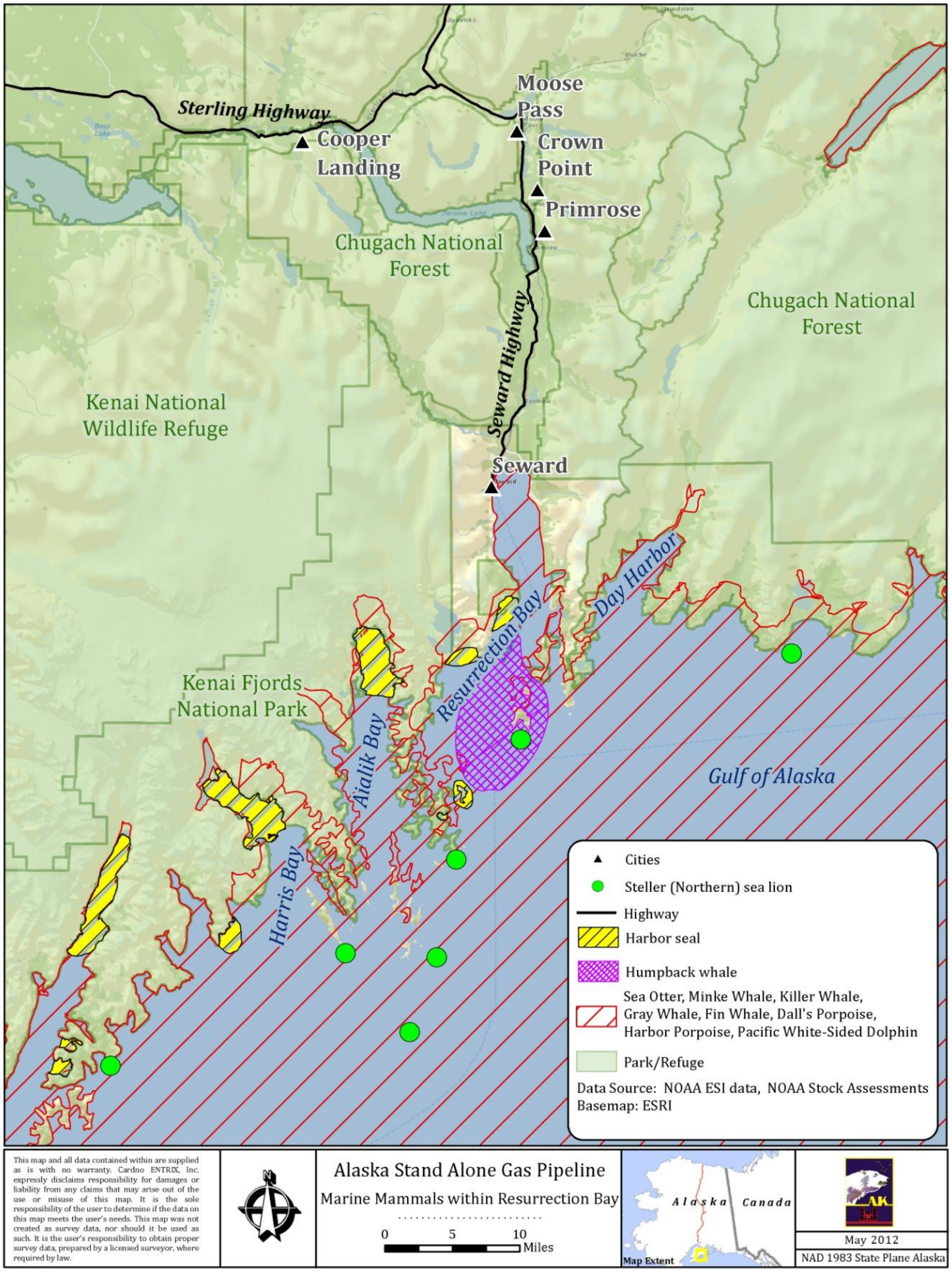

FIGURE 5.7-1 Marine Mammals within the Port of Seward in Resurrection Bay

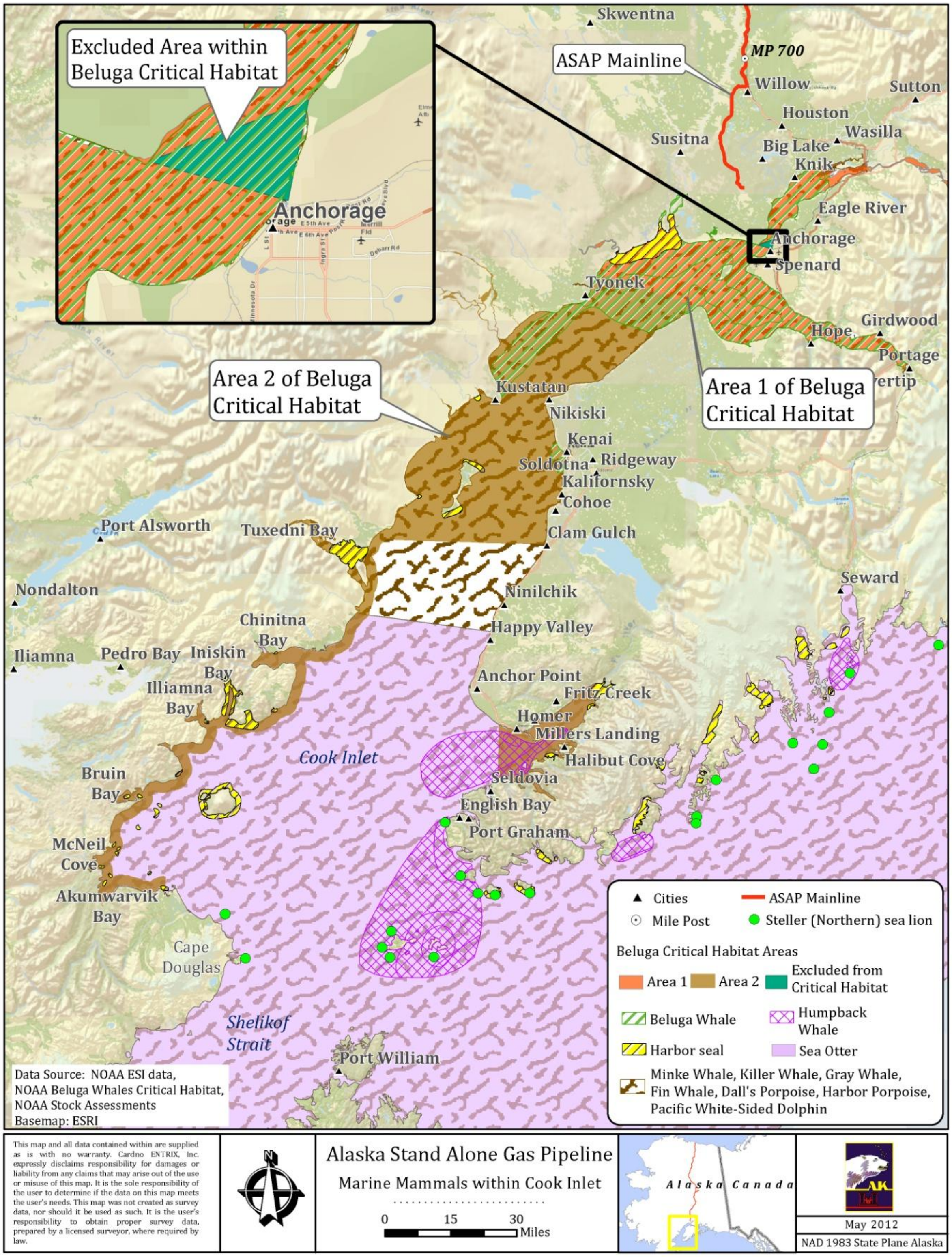

FIGURE 5.7-2 Marine Mammals within Cook Inlet

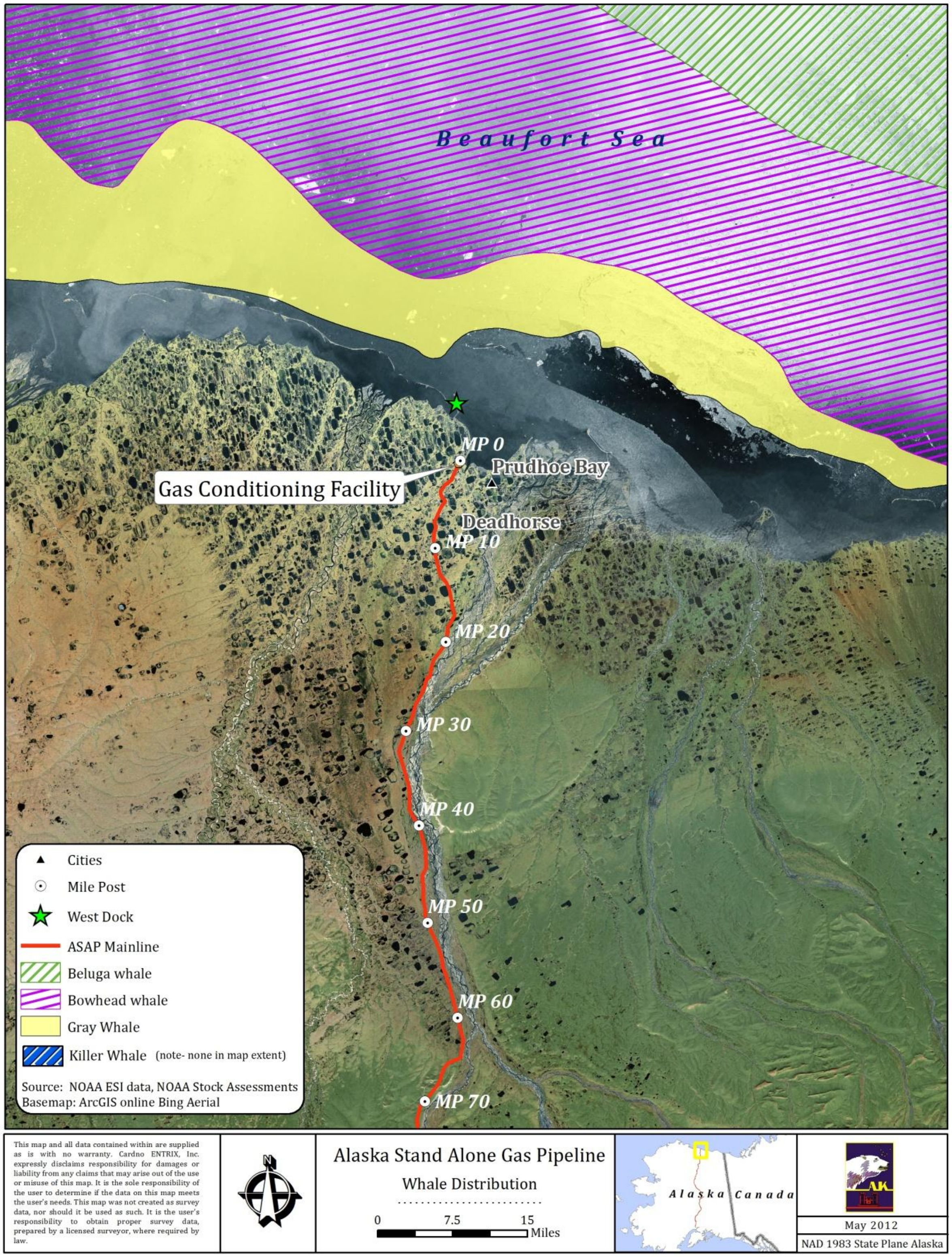

FIGURE 5.7-3 Whale Habitat near West Dock Port in Prudhoe Bay

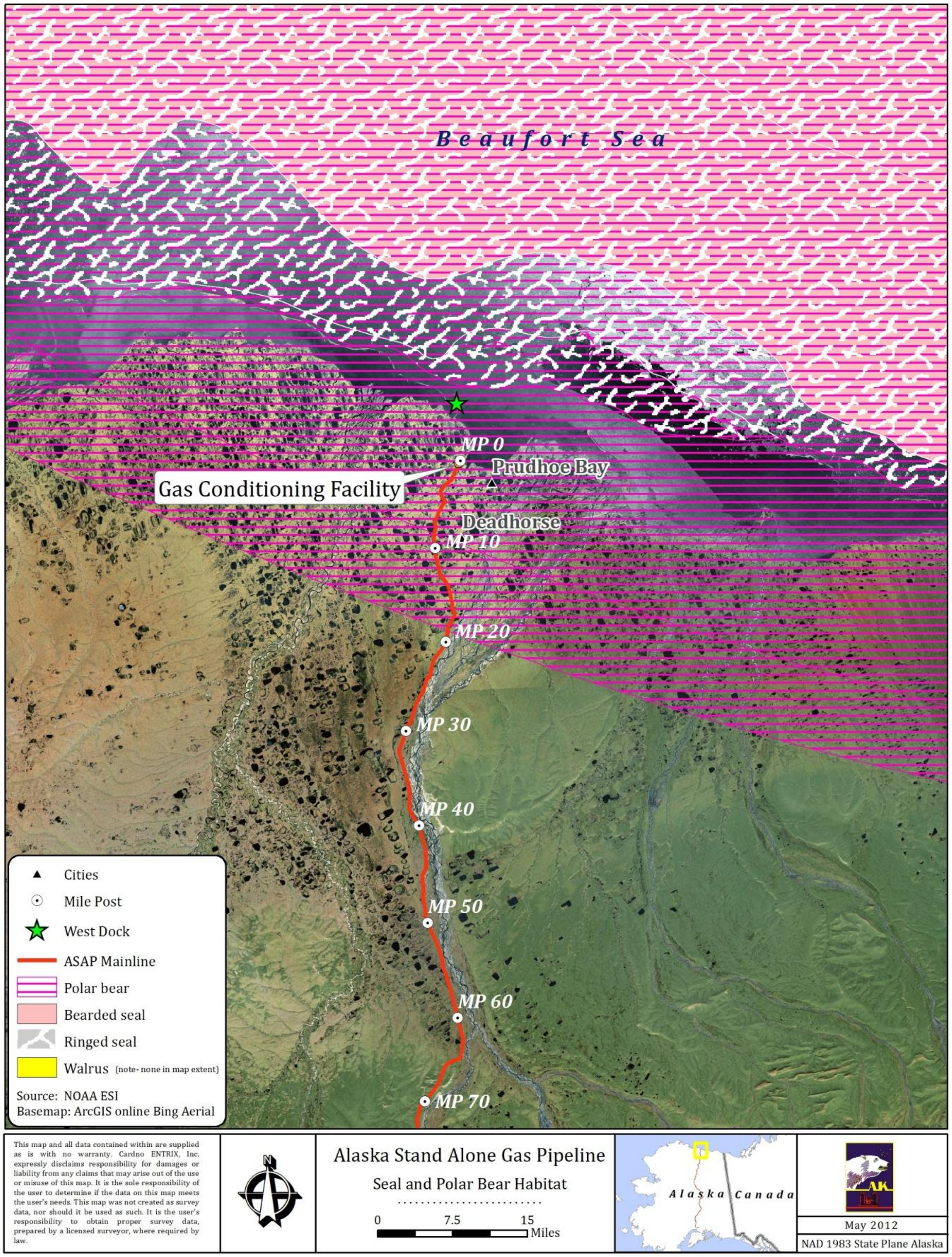

FIGURE 5.7-4 Seal and Polar Bear Habitat near West Dock Port in Prudhoe Bay

Marine mammals that are not endangered, threatened, or candidate species, and were identified by the NMFS as potentially occurring within or adjacent to the proposed Project area are included in Table 5.7-1.

TABLE 5.7-1 Non-Endangered and Non-Threatened Marine Mammals That May Occur in or near the Proposed Project Area

Species	Occurrence in or Adjacent to Project Area	Primary Habitat	Primary Season of Use	Potential to Adversely Affect
West Dock Port				
Gray whale (*Eschrichtius robustus*)	may occur	shallow coastal	summer	no
Beluga whale (*Delphinapterus leucas*)	unlikely	coastal and offshore near ice	summer	no
Killer whale (*Orcinus orca*)	unlikely	coastal and offshore	summer	no
Port of Anchorage				
Harbor seal (*Phoca vitulina*)	may occur	haul out areas and near rivers	summer	no
Cook Inlet				
Minke whale (*Balaenoptera acutorostrata*)	may occur	inshore & offshore	summer	no
Gray whale (*Eschrichtius robustus*)	unlikely	inshore coastal	summer	no
Killer whale (*Orcinus orca*)	may occur	deep water inlet	year round	no
Harbor seal (*Phoca vitulina*)	likely	haul out areas	year round	no
Harbor porpoise (*Phocoenoides phocoena*)	may occur	shallow water inlet	year round	no
Dall's porpoise (*Phocoenoides dalli*)	unlikely	deep water inlet	year round	no
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	unlikely	deep water inlet	year round	no
Port of Seward				
Harbor seal (*Phoca vitulina*)	may occur	haul out areas	year round	no
Minke whale (*Balaenoptera acutorostrata*)	may occur	inshore & offshore	summer	no
Gray whale (*Eschrichtius robustus*)	unlikely	inshore coastal	summer	no
Killer whale (*Orcinus orca*)	may occur	fjords, coastal and offshore	year round	no
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	unlikely	deep water	year round	no
Dall's porpoise (*Phocoenoides dalli*)	unlikely	deep water	year round	no
Harbor porpoise (*Phocoenoides phocoena*)	unlikely	shallow water	year round	no

Source: NOAA 2011.

5.7.1.1 Species Descriptions by Proposed Project Area

Summaries of marine mammals that have the potential to exist in or adjacent to the proposed Project areas are described below under the port area where they could occur. The information used to write the summaries below, was obtained primarily from the Biological Assessment (AGDC 2011a), National Oceanic and Atmospheric Administration (NOAA) Fisheries Office of Protected Resources online information, and NOAA Marine Mammal Stock Assessment Reports. The potential for the species to occur in or adjacent to the proposed Project area was categorized as likely, unlikely, or may occur from documentation noted above (Table 5.7-1). Categorizing a species as "likely" to occur in the proposed Project area was determined when regular habitat use and distribution overlapped with the proposed Project area. A species was categorized as "unlikely" to occur in the proposed Project area if the species does not inhabit the area. Categorizing a species that "may occur" in or adjacent to the proposed Project area would include some habitat use in the area; the species is not common to the area, but low numbers could exist near the proposed Project area.

Port of Seward

The POS is located at the north end of Resurrection Bay in the Gulf of Alaska (Figure 5.7-1). All marine mammals identified by the NMFS that may occur in or adjacent to the POS Project area are described below. ESA species including the fin whale, humpback whale, sea otter and Steller sea lion are discussed further in Section 5.8, T&E Species.

Harbor Seal

Harbor seals are true seals that are widely distributed across the North Pacific and North Atlantic Oceans. There are five subspecies of harbor seal; however, the Alaska stock would be the only stock to potentially occur near the POS. The Alaska stock inhabits the temperate coastal waters from Southeast Alaska to the Bering Sea. Adult harbor seals are approximately 6 feet long, weigh 245 pounds, and are a blue-gray color with light spots or rings. They primarily eat fish (salmon, eulachon), shellfish and other invertebrates in shallow and deep water areas. Harbor seals give birth (pup) during the summer, and use rocks, beaches, ice, and reefs to haul out to rest, to pup, and for thermoregulation.

The harbor seal is one of the most common marine mammals in the Gulf of Alaska. The Gulf of Alaska has numerous fiords, bays, islands, and coastline, which provides optimal habitat for harbor seal haul out areas. Alaskan waters includes three stocks of harbor seal; the Bering Sea, Gulf of Alaska, and Southeastern Alaska. Due to recent genetic findings, NMFS is revisiting the stock structure in Alaska. The Gulf of Alaska population is still relatively small compared to its previous stock size in the 1970s and 1980s (NOAA 2011). The current population estimate for Alaska harbor seals (all three stocks) is 180,017 (NOAA 2011), and the Gulf of Alaska stock population is estimated at 45,975 (Allen and Angliss 2011).

Minke Whale

Minke whales are the smallest species of the baleen whales. These whales have dark, sleek bodies with white undersides that can reach up to 35 feet in length and 20,000 pounds in weight. They usually occur in small groups of 2 to 3 when feeding, but can occur in loose aggregations of up to 400 whales. Minke whales feed primarily on plankton, crustaceans (krill), and small fish (herring, capelin, sand lance, and cod). Minke whales calve in the winter, and mother and calf pairs remain in the lower latitude areas of their range during the overwinter period.

Minke whales have a wide distribution of habitat, from polar (summer) to tropical (winter), and coastal and offshore waters. The Alaska stock is relatively common in the Bering Sea, Chukchi Sea, and inshore waters of the Gulf of Alaska (Allen and Angliss 2010). Older whales will migrate higher in latitude to feed during the summer, and immature whales will stay in lower latitude areas. There are four distinct populations of minke whales. Two distinct populations in U.S. waters are the Alaska stock and the California-Washington-Oregon stock. The Alaska stock is considered migratory and the California-Washington-Oregon stock is resident. There is insufficient data available to determine an accurate population estimate of Alaska stock minke whales (Allen and Angliss 2010). However, the most recent minke whale abundance was estimated to be 1,233 for the Gulf of Alaska to the Central Aleutian Islands areas (Zerbini et al. 2006).

Gray Whale

The gray whale is a large baleen whale with a mottled gray color, and has small eyes. They can grow up to 50 feet long and weigh 80,000 pounds. They are benthic filter feeders that sift through mud on the sea floor to feed on amphipods. Unlike most other whales, gray whales do not have a dorsal fin, but possess a dorsal hump. Gray whales travel solitary or in small groups; however, they have been found in large groups on breeding grounds or in concentrated feeding areas. Due to their feeding behavior, gray whales inhabit shallow (less than 60 meters) coastal waters (Moore and DeMaster 1997).

There are two populations of gray whale: the Eastern North Pacific gray whale that exists in Alaska, and the western North Pacific that inhabits the waters along eastern Asia. The Eastern North Pacific population was delisted from the T&E species list in 1994 due to rebounding population size (NOAA 2011). Gray whales spend their summers feeding primarily in the northern and western Bering and Chukchi seas and winter off the west coast of Baja, California. Gray whales calve in lagoons typically less than 4 meters deep along the west coast of California in January and February before migrating north to Alaskan waters. The most recent abundance estimate (2006–2007) for the Eastern Pacific stock gray whales is 19,126 (Allen and Angliss 2011).

Killer Whale

Killer whales are medium-sized, toothed whales with black backs and white undersides. They are sexually dimorphic, and males can reach 32 feet long and weigh 22,000 pounds; females can reach 28 feet long and weigh 16,500 pounds. Their diet ranges from fish to marine mammals, depending on whether the population is “resident” or “transient”. The eastern North Pacific resident killer whales feed primarily on salmon; transient populations in the same region feed on harbor seals, porpoise, gray whale calves, Steller sea lions, and other whales.

Killer whales are the most widely diverse of the whales, inhabiting oceans all over the world, but are found in higher densities in colder waters. Killer whales are highly social and depend heavily on underwater sound for communication, feeding, and orientation. Killer whales have specific vocalization types, and multiple dialects are known to exist within the same population among different pods in the eastern North Pacific (i.e., residents, transients, and offshore). Killer whales have different characteristics of morphology, ecology, genetics, and behavior. Resident and transient whales differ by the shape of the dorsal fin, skin pigmentation, primary prey (fish or marine mammals) and social group size and stability. Transient killer whales have a more erect dorsal fin, a different patterned pigmentation, and feed entirely on marine mammals and form small, and stable long-term social groups as compared to resident killer whales.

The AT1 transient population of killer whale is considered depleted under the MMPA. This population was first identified as a separate group of whales in the early 1980s in Prince William Sound. Since then, individual whales have been photo identified and re-sighted in Prince William Sound frequently through annual research efforts. This pod of killer whales were some of the most frequently sighted killer whales in this area. By comparison, Gulf of Alaska transient killer whales are rarely seen in Prince William Sound. These whales are acoustically and genetically different than other transient killer whale pods which make the AT1 population discrete from the “Gulf of Alaska” transients (Allen and Angliss 2011). This killer whale population also has a more limited range (200 miles); however, they have been sighted and identified in Resurrection Bay and Aialik Bay year round. The estimated population for the AT1 killer whales is currently 7 (Allen and Angliss 2011).

Pacific White-sided Dolphin

Pacific white-sided dolphins have a robust body with short beaks and a large, curved dorsal fin. Their coloring is typically black with gray sides, dorsal fins, and flippers. Their undersides are white, and they have two long white stripes extending from either side of the beak to the tail. Adult males can reach up to 8 feet long, females are 7.5 feet long, and both males and females can weigh between 300 and 400 pounds. The Pacific white-sided dolphin is an extremely social animal, usually seen in schools of 10 to 100; however, they can occasionally be observed in large groups (thousands). They feed primarily on squid and small fish (capelin, sardines, and herring), and often hunt as a team to herd prey. Calving occurs in the summer months, and females give birth less than every other year (NOAA 2011).

Pacific white-sided dolphins inhabit temperate waters from the continental shelf to offshore waters. Two stocks have been identified for this species; the North Pacific stock and the California-Oregon-Washington stock. The North Pacific stock inhabits the offshore and coastal areas from the Gulf of Alaska, to the Aleutian Islands, and rarely inhabits the southern Bering Sea. The current estimated population for the North Pacific stock is 26,880 (Buckland et al. 1993).

Dall's Porpoise

Dall's porpoise are the fastest swimmers of all cetaceans (NOAA 2011). They are black or dark gray with white on their dorsal fin, tail, and sides. They can reach up to 8 feet long and weigh up to 480 pounds. There are two morphs of this species; the "*truei"* is commonly associated with the Western Pacific Ocean stock, and the "*dalli*" is common in the eastern Pacific population. The morphological difference is the location and size of the white thoracic patches. The Northeast Pacific area also possesses relatively common hybrids of Dall's and harbor porpoise (NOAA 2011). The Dall's porpoise are similar to the Pacific white-sided dolphin in that they typically form groups of 2 to 20, but can be found in groups numbering in the thousands.

Dall's porpoise feed primarily at night on small fish (herring, smelts, and anchovies), squid, octopus, crabs, and shrimp. They can also dive to depths of 1,640 feet when feeding, and prefer to inhabit temperate waters more than 600 feet deep. Calving occurs between June and September, and calves will remain with their mothers less than a year. Dall's porpoise occur throughout the North Pacific; however, the eastern North Pacific population is distributed from Baja California to the Bering Sea. Two stocks have been identified within this population; the Alaska stock and the California-Oregon-Washington Stock. The estimated population for the Alaska stock is 83,400 (Allen and Angliss 2011). There is a distribution gap in Alaskan waters in the upper Cook Inlet and the shallow eastern flats of the Bering Sea (Allen and Angliss 2011). Dall's porpoise are present all months of the year throughout their range in the eastern North Pacific.

Harbor Porpoise

Harbor porpoise have small, dark grey, robust bodies with white undersides, and can reach up to 5.5 feet in length and range from 135 to 170 pounds. They exist in small groups of two to five and feed primarily on small fish (herring, capelin), squid, and octopus. Harbor porpoise inhabit coastal and offshore water in temperate and subarctic waters; however, they are primarily found in bays, fjords, and estuaries less than 650 feet deep (NOAA 2011). The harbor porpoise have a discontinuous population distribution which includes the North Atlantic (west Greenland to Cape Hatteras), from Barents Sea to West Africa, and from Japan to the Chukchi Sea, and Monterey Bay, California to the Beaufort Sea.

There are 10 stocks of harbor porpoise in U.S. waters; the Gulf of Alaska stock is discussed in this section. Harbor porpoise in the Gulf of Alaska are commonly found in coastal waters less than 300 feet deep (Allen and Angliss 2011). Areas of high density use have been observed at Glacier Bay, Icy Strait, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000). It has been recommended to separate the Alaska stock into 3 separate stocks; however, there is insufficient data to justify this at present. The Gulf of Alaska harbor porpoise latest abundance estimate is 31,046 (Allen and Angliss 2011).

Northern Project Area – West Dock Port

The West Dock Port is located approximately 2.7 miles offshore from Prudhoe Bay in the Beaufort Sea (Figure 5.7-3 and 5.7-4). West Dock is used regularly to support oil development in the Prudhoe Bay area. The bowhead whale, Pacific walrus, ringed seal, and bearded seal which inhabit the proposed Project area are discussed in Section 5.8, T&E Species. There are three marine mammals that are not T&E listed that may occur in or adjacent to the proposed Project area at West Dock. These include: the gray whale, beluga whale, and killer whale. Brief summaries of each species are included below.

Gray Whale

Gray whales, as described above, are large baleen whales that feed in shallow waters along the coast of Alaska in the summer, and winter off the coast of California. Most gray whales feed along the coast of the Chukchi and Bering Sea but some travel along the Beaufort Sea coastline to feed. Gray whales were observed during the summer in the Alaskan Chukchi and Beaufort Seas primarily in 40 meter water depths and area with less than 1 percent ice cover (Moore and DeMaster 1997). Shallow coastal and offshore shoals may provide habitat rich in prey for gray whales which may be important feeding areas for gray whales (Moore and DeMaster 1997). The estimated population for the eastern North Pacific gray whales is 19,126 (Allen and Angliss 2011).

Beluga Whale

Beluga whales are medium-sized, toothed whales inhabiting Arctic and sub-Arctic areas. Beluga whales reach up to 14 feet long and weigh approximately 3,000 pounds. Adult beluga whales are white, while calves are dark gray at birth. Beluga whales do not have a dorsal fin, but possess a dorsal ridge and feed on numerous prey items (fish, octopus, crab, clams, mussels, cod, sand worms, and flounder). Beluga whales have a unique trait in that their cervical vertebrae are not fused, allowing them to move their heads side to side and up and down. Beluga whales molt in the summer and utilize gravel substrates near the confluence of rivers and estuaries to rub off the old skin. Beluga whales give birth to one calf in the spring (May–July) in estuaries and bays in relatively warm water (NOAA 2011). Calves are nursed for 2 years and may remain with their mothers for a considerable length of time after.

Beluga whales are very social animals and have highly developed hearing, echolocation, and produce a variety of sounds and calls. They often travel in groups of 10 to several hundred. The Beaufort Sea beluga whales winter in the offshore waters of the Bering Sea near ice leads and polynyas (Allen and Angliss 2011). Polynyas are open water areas surrounded by sea ice. This population may migrate several thousand miles to reach overwinter areas. Beluga whales in the Beaufort Sea primarily feed in the deeper waters in the summer along the ice front; however, small numbers of belugas have been seen along the coastal waters of the Beaufort Sea. The Beaufort Sea beluga whale population estimate is 39,258 (Duval 1993). Five beluga whale stocks exist in Alaska; however, the Cook Inlet stock is considered the only strategic stock of beluga whale (NOAA 2011).

Killer Whale

Killer whales exist along the entire Alaskan coast. Alaskan resident killer whales are found distributed from southern Alaska to the Aleutian Islands and Bering Sea. The population estimate for Alaska resident killer whales is 2,084 (Allen and Angliss 2011).

The transient stock of killer whales inhabits the area from Prince William Sound through the Gulf of Alaska to the Aleutian Islands and Bering Sea. Transient killer whales that inhabit the northern Bering Sea and Beaufort Sea have been lumped into one population that includes the Gulf of Alaska transients. Although genetic information confirms there are three distinct communities of transient killer whales, there is insufficient data to resolve transient populations of killer whales. The most current population estimate for the Gulf of Alaska transient killer whales is 552 (Allen and Angliss 2011).

Port of Anchorage and Cook Inlet

The POA is located in the upper Cook Inlet, north of Ship Creek at the mouth of the Knik arm in Southcentral Alaska (Figure 5.7-2). The Cook Inlet beluga whale, sea otter, Steller sea lion, humpback whale, and fin whale are ESA-listed species that will be discussed in Section 5.8, T&E Species. Seven species of marine mammals that are not ESA-listed which may occur in or adjacent to the proposed Project areas are: harbor seal, minke whale, gray whale, killer whale, Pacific white-sided dolphin, Dall's porpoise, and harbor porpoise. Brief summaries of each species are included below.

Harbor Seal

Cook Inlet harbor seals give birth (pup) from June through August, and peak in early August (Boveng et al. 2007). Harbor seals haul out on beaches, islands, mudflats, and at mouths of rivers in the Cook Inlet to pup and feed on available prey. Their summer distribution is primarily along coastal waters of Cook Inlet; overwinter areas include the lower half of Cook Inlet and the Gulf of Alaska (Boveng et al. 2007). Results of a study conducted by Montgomery et al. (2007) indicate that harbor seals were found to haul out near available prey and to avoid areas high in anthropogenic (human made) disturbance. The current population estimate for harbor seals in the Gulf of Alaska is 45,975 (NOAA 2011).

Minke Whale

Minke whales are considered migratory in the upper areas of their range (Allen and Angliss 2011). They are relatively common in the inshore waters of the Gulf of Alaska, but not considered abundant in any other part of the eastern Pacific Ocean (Allen and Angliss 2011).

Gray Whale

The Eastern North Pacific stock of gray whales primarily feeds in the northern and western Bering and Chukchi Seas during the summers, but whales have also been reported feeding near Kodiak Island, Southeastern Alaska, and south along the Pacific Northwest (Allen and Angliss 2011). Gray whales head south to wintering grounds in November and December, and return northbound after the winter in mid-February to May with newborn calves.

Killer Whale

General biological information on killer whales is noted above in the POS Project area description. Specific population information on transient and resident killer whales inhabiting Cook Inlet and Gulf of Alaska is discussed below.

Killer whales have existed in the lower Cook Inlet for thousands of years (Sheldon et al. 2003). The Cook Inlet population of killer whale is thought to be a mix of resident and transient individuals. Matkin et al. (1999) determined that of the 291 killer whales (photo identified) in Southcentral Alaska (Prince William Sound, Kenai Fjords, and Cook Inlet), 54 were transient. Most of the confirmed sightings of killer whales in Cook Inlet were located in the lower inlet area. There have been only 18 sightings of killer whales in upper Cook Inlet within the past 27 years (Sheldon et al. 2003). The small pod size and physical characteristics noted above for transient killer whales was observed in upper Cook Inlet, indicating that they were transient killer whales.

Two transient killer whale pods exist in the Gulf of Alaska, the Gulf of Alaska transients, and the AT1 transients. The Gulf of Alaska transients are seen throughout the Gulf of Alaska, including occasional sightings in Prince William Sound. The AT1 transients primarily inhabit the Prince William Sound and the Kenai Fjord areas. As noted earlier, the population estimate for transient killer whales is 552 (Allen and Angliss 2011). The Alaskan resident population of killer whale includes whales that inhabit areas from Southeastern Alaska to the Aleutian Islands and Bering Sea. As listed above, the population estimate for Alaskan resident killer whales is 2,084 whales (Allen and Angliss 2011).

Pacific White-sided Dolphin

Little information is known about the distribution of the Pacific white-sided dolphin in Cook Inlet or the Gulf of Alaska. Pacific white-sided dolphins would be expected to inhabit the lower Cook Inlet more than the upper Cook Inlet, near the POA due to the prey they eat and their pelagic habitat distribution (NOAA 2011).

Dall's Porpoise

Dall's porpoise have been sighted across the North Pacific and eastern North Pacific; however, there is a distribution gap in the Cook Inlet area and the shallow eastern flats of the Bering Sea (Allen and Angliss 2011).

Harbor Porpoise

The harbor porpoise in the Cook Inlet is the same population that inhabits the Gulf of Alaska and POS discussed above. The three stocks that inhabit waters of Alaska are listed as strategic stocks, which include the Bering Sea, Gulf of Alaska, and Southeastern Alaska stocks. Little information exists on harbor porpoise use of the Cook Inlet area. An aerial survey was conducted between 1993 and 1994 in Cook Inlet to determine abundance of harbor porpoise. This study estimated that a population of around 135 harbor porpoise inhabited Cook Inlet (Dahlheim et al. 2000). Preliminary data collected by Small (2010) detected harbor porpoise echolocations during a Cook Inlet beluga whale acoustic study conducted between 2007 and

2010. The presence of harbor porpoise presence was especially prevalent in the lower inlet even with the short sampling periods. However, this species was also briefly detected in the upper inlet at Cairn Point and Beluga River.

5.7.2 Environmental Consequences

5.7.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed and there would be no impacts to marine mammals.

5.7.2.2 Proposed Action

Construction Phase

The proposed Project would require the temporary use of up to three port sites during the construction phase of the proposed Project to transport materials and equipment required for proposed Project development. The 2-year construction period would be the only time that port activity would be required for the proposed Project. The proposed Project would also be further limited to port use during the open water season for the northern Project area at West Dock in the Beaufort Sea. Shipping would not occur during periods of sea ice development in the Arctic. The POS would be the planned port of entry for pipe and equipment delivery due to Alaska Railroad (ARR) access, available storage, and year round accessibility.

Vessel Activity

Vessel use is the only construction activity that would occur in the marine environment for the proposed Project. Pipe would be shipped to the POS and potentially the POA using Small Handy Class cargo ships which are capable of carrying up to 10,000 tons per shipment (AGDC 2011b). West Dock would receive modules by sealift typical in use for North Slope deliveries. These barges typically have a deck area of 400 feet by 100 feet and are 25 feet deep. The AGDC sealift estimates are based on maintaining a barge draft of less than 5.5 feet to allow for access to West Dock. The potential impacts that could occur to marine mammals from vessel use in or near the proposed Project areas are included below.

Disturbance

Disturbance to marine mammals from vessel activity could be in the form of noise, movement, or a potential collision. Vessel noise would be the likeliest impact with the potential to disturb marine mammals and will be discussed in detail. The audibility of a sound is determined by radiated acoustic power, propagation efficiency, ambient noise, and the hearing sensitivity of the marine mammal receiving the sound (Richardson et al. 1995). Sound propagation can be affected by many variables in the marine environment including: bathymetry, substrate, frequency, intensity, and pressure of the sound. Underwater noise received from the source can depend on direction, source depth, receiver depth as well as distance. For example, a sound produced in the same area at different times may be detected at highly varied distances depending on regional and temporal changes altering the sounds propagation conditions. A moderate sound level transmitted over an efficient pathway could be received at the same distance and level as a higher level sound source due to attenuation. The way in which a species hears a sound also has many variables, which makes it difficult to determine how vessel noise affects marine mammals.

Sounds levels and frequency characteristics are roughly related to ship size and speed, but there is significant individual variation among vessels of similar classes (Richardson et al. 1995). Vessels produce low frequency underwater noise (less than 180 dB) from their engines which could cause some temporary avoidance behavior of marine mammals. As noted above, there are many variables involved in determining how underwater sound characteristics affect marine mammals. The low frequency noise produced could attribute disturbance more to baleen whales that communicate at low frequencies (10 Hz to 31 kHz) compared to other marine mammals (Richardson et al. 1995). Marine mammal exposure to high noise levels could result in a temporary threshold shift which can last from minutes to days (Richardson et al. 1995). The magnitude of the temporary threshold shift depends on the level and duration of noise exposure in addition to other factors. Negative effects include the temporary inability for marine mammals to hear natural sounds for communication, locating predators and prey, and navigation. Noise produced from the expected increase in vessel activity along transportation routes would be considered relatively temporary, and localized. Marine mammals could be displaced temporarily if they are found in the vicinity of vessel activity. It is expected that marine mammals would swim away from the noise source until a comfortable distance has been reached and return to natural behavior. Marine mammals would likely be habituated to the existing regular vessel traffic use of these shipping lanes and port use throughout the year.

Cargo vessels primarily travel in a relatively slow, forward, linear direction, with minimal course changes. The consistent pattern and speed of travel would enable marine mammals to predict and avoid the path of vessel movement. Vessel strike information collected between 1978 and 2006 indicates that small (less than 15m) vessels were responsible for the largest number of whale-vessel collisions (Gabriele et al. 2007). Jensen and Silber (2003), however, have determined that all type and size of vessels pose a threat for whale collisions. Collisions can also be specific to the species (fin and humpback whales). Fin and humpback whales are the victims of most vessel collisions due to feeding behavior along near shore areas that overlap with the majority of small boat and cruise ship activity. Sixty-two collisions were reported in Alaskan waters between 1978 and 2006; the majority (74 percent) was humpback whales, and occurred in Southeastern Alaska (Gabriele et al. 2007).

Five whale collisions (8 percent) out of the 62 were reported between 1978 and 2006 from Gabriele et al. (2007) in the area proposed for vessel use for the proposed Project. Two of the vessels were very large (>600 feet long), one container ship at the POA and one cruise ship at the POS and the remaining three vessel collisions with whales reported were a charter boat and commercial fishing vessel (each 27 feet long) and a tour boat (87 feet long). Vessel activity for the proposed Project would not significantly increase the volume of marine traffic in the port areas. No small handy class sized cargo vessels within the proposed Project area have been reported to cause whale collisions based on the data noted above. Current information indicates that collisions with whales are not a substantial source of injury or mortality (NMFS 2008).

Masking

Masking is the potential for vessel sounds to “mask” or obscure whale sounds needed for communication and detection of their environment. Masking can impede echolocation which is necessary for marine mammals to hear and function in the marine environment. Vessel movement would be transitory through the proposed Project areas, which would produce minimal and temporary impacts to local whales associated along the transportation corridors and port locations.

Other Impacts

Vessels could unintentionally transport aquatic invasive species on hulls or within ballast waters, which could lead to reduced habitat suitability for marine mammals. Routine vessel operations could result in small leaks of fuel and lubricants that are toxic to marine mammals. Marine mammals that frequent harbor areas, such as harbor seals or Steller sea lions, would be most likely to be exposed to chronic leaks and spills. This would be a near negligible impact when considering the relatively minimal vessel activity the proposed Project would produce in relation to regular vessel traffic in the proposed Project area. Loss of power and grounding of transport vessels could lead to rupture of fuel tanks and larger accidental spills that are toxic to marine mammals. Most marine mammals would avoid areas with active fuel spills, but some exposure could occur.

Description of Use by Project Area

Port of Seward

Thirty-five shipments would be required during the construction phase of the Project to fulfill pipe delivery to the POS (AGDC 2011b). The 2010 port calls at the ARR freight dock was 200 (146 freight vessels and 54 cruise ships) at the POS (ARR 2011). The expected increase in vessel activity within the POS ARR freight dock from Project construction would be approximately 17 percent. In addition to the ARR freight dock, various size vessels arrive and depart the POS small boat harbor daily throughout the year. These vessels include wildlife tour boats, commercial fishing boats, and recreational boats. Most marine mammals would likely be conditioned or habituated to the regular vessel activity and associated noise in the POS area and Gulf of Alaska. Table 5.7-2 includes a summary of the species, primary habitat, likelihood of occurrence and potential to adversely be affected by increased vessel traffic.

Harbor Seals

Harbor seals are year-round residents in the Gulf of Alaska. Few harbor seals would be likely to occur at the POS as most harbor seals would occur near haul out areas. Individual seals that inhabit the POS area would likely be habituated to the existing vessel activity. Harbor seals that would come in contact with vessel traffic would swim or dive away from vessel noise. Harbor seals would not be adversely affected from the increase in vessel traffic created from construction activities of the proposed Project.

Minke Whales

Minke whales primarily inhabit the Gulf of Alaska fjord areas in the summer to feed on schooling fish and krill. They are not known to frequently inhabit the north end of Resurrection Bay near the POS. Vessel noise and movement would potentially cause disturbance to minke whales which would temporarily alter whale feeding behavior. Minke whales would swim away from the source of disturbance until a comfortable distance has been reached and continue feeding. Vessel traffic produced from proposed Project construction activity would not adversely affect minke whales at the POS.

Gray Whales

Gray whales are not known to inhabit the POS area or the Gulf of Alaska because they feed primarily along the shallow waters of the northern and western Bering and Chukchi seas. Vessel traffic from the proposed Project would not adversely affect gray whales near the POS or Resurrection Bay.

Killer Whales

The transient killer whales (AT1 and Gulf of Alaska stocks) are the primary killer whale stocks that would come in contact with additional vessel traffic in Gulf of Alaska if vessel activity occurred in the summer. However, if vessel activity occurred in the fall through spring, up to 7 resident killer whale pods could be utilizing the same area (Yurk et al. 2010). Killer whales are not known to frequent the POS area; however, a 5 year acoustic study conducted by Yurk et al. (2010) detected 7 distinct resident killer whale pods in Prince William Sound between September and May. As stated earlier, sightings of the AT1 stock have been rare in recent years, and the population includes an estimate of 7 individuals (Matkin et al. 1999). Killer whales would react to vessel activity similar to other whales. Natural behavior would be disturbed temporarily until the vessel was at a comfortable distance for the whales to return to normal behavior. It is unlikely that killer whales would be adversely affected by a 17 percent increase in vessel traffic at the POS.

Pacific White-sided Dolphin, and Dall's Porpoise

The Pacific white-sided dolphin and Dall's porpoise are often associated together and inhabit the offshore and coastal areas of the Gulf of Alaska and Prince William Sound. These species are fast, agile swimmers that have the ability to escape any potential disturbance from vessel traffic. These species are not known to utilize the habitat at the POS, and would likely be habituated to vessel traffic in the Resurrection Bay. Dall's porpoise in particular are known for bow riding vessels in the Prince William Sound area. An increase in vessel traffic at the POS would be not adversely affect Pacific white-sided dolphin or Dall's porpoise.

Harbor Porpoise

Harbor porpoise are coastal species that prefer to inhabit bays, estuaries, fjords, and harbors less than 100 meters deep. Areas of known high densities include Glacier Bay, Icy Strait, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dahlheim et al. 2000), where prey are concentrated. Cargo vessel traffic utilizes shipping lanes and routes in the Gulf of Alaska, which are not typically located within shallow nearshore waters. Few harbor porpoise, if any, would be associated with the POS area due to the 150 to 300 meter water depth in Resurrection Bay (Suleimani et al. 2009) as they prefer shallower waters. Harbor porpoise would not be adversely affected from the proposed additional vessel activity.

TABLE 5.7-2 Marine Mammal Occurrence, Stock Size, Habitat, and Potential to be Adversely Affected by the Proposed Project

Species	Potential for Occurrence and Estimated Regional Stock Size				Primary Habitat	Potential to be Adversely Affected
	West Dock	Cook Inlet	Port of Anchorage	Port of Seward		
Harbor Seal *(Phoca vitulina)*	NA does not occur	45,975 likely to occur	45,975 may occur	45,975 may occur	haul out coastal areas rocks, beaches	no
Minke Whale *(Balaenoptera acutorostrata)*	NA does not occur	1,233 may occur	NA unlikely to occur	1,233 may occur	bays, fjords and offshore	no
Gray Whale *(Eschrichtius robustus)*	19,126 may occur	19,126 unlikely to occur	NA unlikely to occur	19,126 unlikely to occur	coastal shallow water (<100m deep	no
Killer Whale *(Orcinus orca)*	2,084R unlikely to occur	552T; 2,084R may occur	0R; 0T unlikely to occur	552T; 7T; 2,084R may occur	fjords, coastal and offshore	no
Pacific White-sided Dolphin *(Lagenorhynchus obliquidens)*	NA does not occur	26,880 unlikely to occur	NA unlikely to occur	26,880 unlikely to occur	fjords, coastal and offshore	no
Harbor Porpoise *(Phocoena phocoena)*	NA does not occur	31,046 may occur 136 Cook Inlet	NA may occur	31,046 unlikely to occur	coastal areas, shallow water <300 feet	no
Dall's Porpoise *(Phocoenoides dalli)*	NA does not occur	83,400 unlikely to occur	NA unlikely to occur	83,400 unlikely to occur	fjords, coastal and offshore	no
Beluga Whale (*Delphinapterus leucas*)	39,258 unlikely to occur	T and E Section 5.8	T and E Section 5.8	NA does not occur	coastal water, and offshore near ice	no

T = Transient
R = Resident
NA = Not Applicable
Sources: Allen and Angliss 2011, Dalheim et al. 2000.

Northern Project Area – West Dock

Nine shipments would be required to complete delivery of all materials and equipment to the northern proposed Project area for right-of-way (ROW) and Gas Conditioning Facility (GCF) development at Prudhoe Bay (AGDC 2011b). The 2010 port calls for commercial barges at West Dock was 182 vessels (W. Nash Pers. Comm. 2011). This vessel count does not include barges that land at the beach heads or the hovercraft usage to Northstar Island. Hovercraft is the primary mode of transportation to Northstar Island; however, its use is wave and weather dependant. The frequency of hovercraft use can range between 3 to 7 round trips per day depending on the activity on the island (W. Nash Pers. Comm. 2011). Vessel activity for the proposed Project construction period would increase vessel traffic at the West Dock Port by 5 percent or less compared to 2010 vessel use noted above. For further information on the summary of the species, primary habitat, likelihood of occurrence, and potential to adversely be affected by increased vessel traffic see Table 5.7-2.

Gray Whales

Most of the Eastern North Pacific gray whale population spends the summer feeding in the northern and western Bering and Chukchi seas (Rice and Wolman 1971, Nerini 1980). Minimal information exists on gray whale use in the coastal waters of the Beaufort Sea; however, Maher (1960) indicated that gray whales inhabit the western coastline of the Beaufort Sea as far as Barter Island. In 1980, Rugh and Fraker (1981) observed 3 gray whale sightings in the eastern Canadian Beaufort Sea. Overall, gray whales are not expected to be abundant in the area. The slow movement and shallow water feeding behavior of the species may coincide with areas of near shore vessel activity along the transportation route. Moore and Clarke (2002) illustrated that gray whales respond to continuous broadband noise when sounds levels exceed *ca* 120dB[2] and to intermittent noise when levels exceed *ca* 170dB by changing their swimming course to avoid the noise source. The few gray whales that may exist in the proposed Project area would avoid vessel activity and move away from the disturbance. A 9 shipment increase in vessel traffic over the 2 year construction period would not cause adverse impacts to gray whales.

Beluga Whales

Beluga whales have not been documented to inhabit the West Dock area, but the possibility exists for a few whales to occur along the transportation route during their westbound migration in the fall. The Beaufort Sea beluga whale population primarily inhabits deep water areas along ice edges. Increased vessel traffic may temporarily disturb and cause masking effects to beluga whales if they were found in the transportation lanes to West Dock. The common reaction of beluga whales from vessel activity would be to swim away from the source of the noise. Beluga whales would not be adversely affected by vessel traffic in the West Dock area from construction activity.

Killer Whales

Little information is known about killer whale habitat distribution in the Beaufort Sea. Killer whales have not been documented inhabiting the shallow coastal waters of the West Dock area. Killer whales in the Beaufort Sea are likely transient whales, and would potentially inhabit areas where bowhead whales migrate with calves, or in areas where beluga whales are common. However, transient killer whales may also prey on gray whales which inhabit shallow water areas to feed. Few killer whales would be found within the transportation route to West Dock. Killer whales would avoid areas with anthropogenic noise by swimming away from the source, and would not be adversely affected by construction activities of the proposed Project.

Port of Anchorage

The POA receives approximately 500 port calls annually (POA 2011). These vessels primarily include container ships, dredges, oil barges, tugs, and oil tankers. It is undetermined what vessel use would occur at the POA from the proposed Project. The POA could be used as an additional port site to supplement the 35 vessel shipments expected for the POS. Table 5.7-2 includes a summary of the species, primary habitat, likelihood of occurrence, and potential to be adversely affected by increased vessel traffic.

Harbor Seal

Harbor seals that occur in the POA area would likely be habituated to vessel activity. Relatively few harbor seals would be expected to occur in the area, and would potentially occur during the peak of salmon runs into Ship Creek, or the Knik Arm drainages. Harbor seals would avoid areas with anthropogenic sounds, by diving and swimming away from the noise source. Harbor seals would not be adversely impacted by the additional vessel traffic in the POA from supply shipment for construction activities of the proposed Project. Harbor seals in Cook Inlet primarily pup, haul out, and feed in the summer near river mouths where prey is plentiful. Harbor seals that inhabit Cook Inlet would not be adversely affected by increased vessel traffic.

Minke Whale

The minke whale would be the most likely to occur in lower Cook Inlet than the POA, due to feeding behavior and habitat characteristics. Minke whales could occur in the vicinity of vessel activity during the summer along shipping lanes when vessels enter Cook Inlet. Minke whales would avoid vessel activity by swimming away to utilize alternate feeding areas. Temporary habitat disturbance could occur, delaying feeding activities; however, no adverse affects would be expected from increased vessel use in the Cook Inlet from proposed Project development.

Gray Whale

Gray whales would not be adversely affected by increased vessel traffic in Cook Inlet from proposed Project construction activities. As noted above, gray whales primarily inhabit the west coastal areas of Alaska outside of Cook Inlet.

Killer Whale

Resident and transient killer whales likely inhabit lower Cook Inlet, but the rare occurrence of transient killer whales has only been documented in upper Cook Inlet waters (Sheldon et al. 2003). Killer whales could occur in the vicinity of vessel shipping lanes in lower Cook Inlet; however, the potential increase in vessel activity would not adversely affect killer whales. Disturbance from vessel traffic would temporarily displace killer whales from feeding or travelling within the lower Cook Inlet.

Pacific White-sided Dolphin and Dall's Porpoise

The Pacific white-sided dolphin and Dall's porpoise overlap in their distribution and are therefore discussed together. These species could likely occur in lower Cook Inlet waters and could potentially be associated with shipping lane areas. These species are playful, agile swimmers and are often found bow riding in the wake of boats. Pacific white-sided dolphins and Dall's porpoise would not be adversely affected by a potential increase in vessel activity in Cook Inlet from proposed Project construction.

Harbor Porpoise

Harbor porpoise inhabit relatively shallow water areas as stated above, and would not likely be found in the path of vessel traffic in lower Cook Inlet. Harbor porpoise also inhabit upper Cook Inlet and could occupy areas near the POA during periods when prey is available in Ship Creek or Knik arm drainages. Harbor porpoise that inhabit the waters near the POA would likely be habituated to vessel traffic. Disturbance to harbor porpoise would result in the temporary changes in behavior, including swimming away or diving to get away from the noise source. Harbor porpoise would not be adversely affected by a potential increase in vessel traffic from construction activities.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (the Applicant's Preferred Option) construct a new aerial suspension bridge; (Option 2) utilize the existing E.L. Patton Bridge; or (Option 3) utilize Horizontal Directional Drilling (HDD) methods to cross underneath the Yukon River. Construction and operation of the proposed pipeline across the Yukon River would occur outside marine mammal habitats, and marine mammals would not be affected by any option.

Aboveground Facilities

Construction and operation of the aboveground facilities (Section 2.1.2) would not adversely affect marine mammals. All aboveground facilities would be located outside of marine environments, primarily on land or across freshwater drainages.

Operation Phase

No action is planned by the proposed Project at any port or docking locations during the operation and maintenance phases. Marine mammals would not be adversely affected by operation and maintenance of the proposed Project.

5.7.2.3 Denali National Park Route Variation

Construction and operation of the Denali National Park Route Variation and the mainline route milepost (MP) 540 to MP 555 would occur outside of the marine environment. The Denali National Park Route Variation and the mainline route from MP 540 to MP 555 would not adversely affect marine mammals.

5.7.3 References

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5.7.3.1 Personal Communications

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5.8 THREATENED AND ENDANGERED SPECIES

5.8.1 Background Information

This section addresses all species[1] that are federally listed as endangered, threatened, proposed for listing, candidates for listing (USFWS 2010), and state listed endangered species (ADFG 1998).

The U.S. Army Corps of Engineers (USACE), as the lead federal agency for the proposed Project, ensures compliance with Section 7 of the Endangered Species Act (ESA). The ESA requires consultation with United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to determine the likelihood of effects on federally listed species. The USACE consulted with the USFWS and NMFS to determine whether listed or proposed ESA species or their designated critical habitat occur in the vicinity of the proposed Project. As a result, the USACE has determined that ESA protected species or habitats may be affected by the proposed Project; therefore, a Biological Assessment (BA) was prepared (AGDC 2011b). In addition, a Biological Opinion (BO) was developed by the USFWS which describes the effects of the proposed action on Alaska-breeding Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), polar bears (*Ursus maritimus*), and polar bear critical habitat pursuant to section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). The Alaska Gasline Development Corporation (AGDC) will require permit approval by the USACE for the development of the proposed Project.

Both the USFWS and NMFS authored letters dated December 17, 2010 and December 10, 2010, respectively, which addressed the ESA, the Fish and Wildlife Coordination Act (FWCA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), the Marine Mammal Protection Act (MMPA), and the National Environmental Policy Act (NEPA). A list of ESA species with the potential to occur in the proposed Project area were identified in both letters and are discussed in detail below.

5.8.2 ESA Protected, Candidate, and Delisted Species

The USFWS and the NMFS are responsible for ensuring compliance with the ESA for species under their jurisdictions. The purpose of the ESA is to conserve species and their habitats. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range, and a species is considered threatened if the species is likely to become endangered in the future. Proposed species are protected candidate species that are found to warrant listing under the ESA as either endangered or threatened and have been proposed as such in the federal register. Candidate species are those species that are petitioned for listing as endangered or threatened under the ESA but that have not been proposed as such in the federal register. Candidate species are currently not federally protected and are addressed in Section 5.8.3. Delisted species are species that were listed as threatened or endangered under

[1] The text of this section primarily refers to species by their common name. Scientific names are provided for most species in Tables 5.8-1, and 5.8-2 of this section. Where animals or plants are not presented in these tables, the initial mention of the common name is immediately followed by presentation of the scientific name.

the ESA but have been formally removed from the listing. Delisted species are not ESA protected and are considered in assessments as state listed species in Section 5.8.4.

The State of Alaska maintains an ESA list of Alaskan species but no longer maintains a State Species of Special Concern list as of August 15, 2011. Therefore, these previously state listed species have not been included in the following analyses. Several ESA protected species under the jurisdiction of the USFWS could potentially be affected by the proposed Project and are addressed within this section. The Bureau of Land Management (BLM) Sensitive Species are addressed in Section 5.3, Terrestrial Vegetation, Section 5.5, Wildlife, and Section 5.6, Fish.

5.8.3 Summary of ESA Protected and Candidate Species in the Proposed Project Area

The ESA protected and candidate species that could occur in the Project area include ten marine mammal and four avian species. Critical habitat for two ESA listed species occurs within the proposed Project area including the Cook Inlet beluga whale under NMFS jurisdiction and the polar bear under USFWS jurisdiction. No federal or state listed plants are found to occur in the proposed Project area based on inventories conducted to date. The federal status, critical habitat designation, and the preliminary findings summary of each species are included in Table 5.8-1.

TABLE 5.8-1 ESA Protected and Candidate Species Potentially Occurring in or near the Proposed Project Area

Common Name	Scientific Name	Federal Status	Critical Habitat Designated in/near Project Area	Preliminary Findings Summary[a]	Population Level Effect
Mammal					
Bearded seal (DPS)	*Erignathus barbatus*	Proposed	No	NLAA	Negligible
Bowhead whale	*Balaena mysticetus*	Endangered	No	NLAA	Negligible
Cook Inlet beluga whale (DPS)	*Delphinapterus leucas*	Endangered	Yes	NLAA/ NAM	Negligible/ No Effect
Fin whale	*Balaenoptera physalus*	Endangered	No	NLAA	Negligible
Humpback whale	*Megaptera novaeangliae*	Endangered	No	NLAA	Negligible
Pacific walrus	*Odobenus rosmarus divergens*	Candidate	No	No Affect (BA) NLJE (BO)	No Effect
Polar bear	*Ursus maritimus*	Threatened	Yes	LAA/NLAM	Negligible
Ringed seal	*Phoca hispida*	Proposed	No	NLAA	Negligible
Steller sea lion (WDPS)	*Umatopias jubatus*	Threatened	No	NLAA	Negligible
Sea otter (DPS)	*Enhydra lutris kenyoni*	Threatened	No	NLAA	No Effect

TABLE 5.8-1 ESA Protected and Candidate Species Potentially Occurring in or near the Proposed Project Area

Common Name	Scientific Name	Federal Status	Critical Habitat Designated in/near Project Area	Preliminary Findings Summary[a]	Population Level Effect
Avian					
Eskimo curlew	*Numenius borealis*	Endangered	No	No Affect (Considered Extinct)	No Effect
Spectacled eider	*Somateria fischeri*	Threatened	No	NLAA	Negligible
Steller's eider	*Polysticta stelleri*	Threatened	No	No Affect (BA) NLAA (BO)	No Effect
Yellow-billed loon	*Gavia adamsii*	Candidate	No	NLAA	Negligible

[a] LAA – May effect, likely to adversely affect.
NA – Not Applicable.
No Affect – No effect.
NLAA – May effect, not likely to adversely affect.
NLJE – Not Likely to jeopardize existence
NAM – No adverse modification (applies to Critical Habitat).
NLAM – Not likely to adversely modify (applies to Critical Habitat).
LAM – Likely to adversely modify (applies to Critical Habitat).
WDPS – Western Distinct Population Segment
DPS – Distinct Population Segment

Sources: ASAP Biological Assessment (AGDC 2011b), ASAP Biological Opinion (BO) (USFWS 2012c) (both provided in Appendix I), USFWS 2012a, USFWS 2012b.

The BA and BO have the same conclusions except for the Pacific walrus and Steller's eider as noted in the table.

5.8.4 Project Area

The proposed Project area for threatened and endangered species includes the 737-mile mainline pipeline right-of-way (ROW), Fairbanks Lateral, Denali National Park Route Variation, and aboveground facilities. Three existing port facilities through which construction materials would be transported and an area 0.25 mile seaward from ship docking facilities are included. Most of the ESA species that could be affected by the proposed Project are found primarily or exclusively in the marine environment. Proposed Project area components within the marine environment are identified below.

- Nine vessels would be required to complete shipment delivery to West Dock on the Beaufort Sea to develop the GCF and pipeline;
- Thirty-five small handy class cargo ships are planned to complete pipe and equipment delivery to the Port of Seward (POS) in Resurrection Bay; and
- The Port of Anchorage (POA) in the Upper Cook Inlet may also be used to supplement vessel shipments planned for the POS, pending confirmation.

5.8.4.1 Project Segments

All terrestrial based construction and operation activities, infrastructure, alternatives, and options would not be expected to impact marine mammals except for polar bears, which are the only mammalian species to den on land within the proposed Project area. In addition, ESA listed avian species that nest on land may also be impacted by terrestrial based construction and operation activities. Marine vessel traffic would be expected to potentially impact the threatened and endangered marine mammalian species.

The NMFS consultation letter dated January 11, 2012 states that the proposed Project would not likely adversely affect ESA listed or candidate species or their critical habitat under their jurisdiction. The terrestrial based components of the proposed Project are discussed briefly below.

Mainline Pipeline and Fairbanks Lateral

The mainline ROW and Fairbanks Lateral ROW construction and operations would not impact ESA listed marine mammals, but could impact the polar bear and avian species. Potential impacts will be described under the environmental consequences for the polar bear and avian species.

Aboveground and Support Facilities

Construction and operation of the aboveground and support facilities would occur in the terrestrial environment. Vessels associated with delivery of modules, equipment, pipeline materials and supplies that may be delivered to West Dock or the POS for construction of aboveground, and support facilities would comply with recommendations from the NMFS and USFWS for vessel operations at those associated port sites. Potential impacts from aboveground facilities development will be described under the environmental consequences for the polar bear and avian species below. Mitigation measures for ESA listed species potentially affected by aboveground facilities, including polar bear, yellow-billed loon, spectacles, and Steller's eider, are included in Section 5.23.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (the Applicant's Preferred Option) construct a new aerial suspension bridge; (Option 2) utilize the existing E.L. Patton Bridge; or (Option 3) utilize Horizontal Directional Drilling (HDD) methods. Construction and operation of the Yukon River crossing options would occur outside ESA, proposed, and candidate listed species habitats for the proposed Project.

5.8.4.2 Denali National Park Route Variation

Construction and operation of the Denali National Park Route Variation would occur outside of the ESA listed, proposed and candidate species habitats for the proposed Project.

5.8.4.3 No Action Alternative

Under the No Action Alternative, the AGDC would not construct the proposed Project and there would be no direct or indirect impacts to the ESA listed, candidate or proposed species.

5.8.5 Species Descriptions

5.8.5.1 Bearded Seal

Affected Environment

The Beringia Distinct Population Segment (DPS) of the bearded seal occurring in the Bering, Chukchi, and Beaufort Seas was proposed for listing as a threatened species throughout its range on December 10, 2010 (75 FR 237:77496) (NMFS 2010a). No critical habitat has been designated for this species.

Bearded seals are the largest of the ice seals, weighing up to 750 pounds. They feed on benthic organisms on or in the sediments on the seafloor; including crabs, shrimp, and clams (NMFS 2010a). Single pups are born on drifting ice flow during late March through May (Kovacs et al. 1996). During summer months, bearded seals in the Beaufort Sea are found associated with fragmented multi-year ice over the continental shelf seaward of the scour zone (Funk et al. 2007). Of the seals observed during surveys conducted east of Endicott 14 miles west of West Dock, about 7 percent were bearded seals; with an estimated summer density of 0.008 seals per square mile (Funk et al. 2007). Few bearded seals are expected to be present near West Dock. There are no reliable estimates of the bearded seal population in the Beaufort Sea, although uncorrected estimates of bearded seals in the eastern Beaufort Sea have been estimated at about 2,100 seals (NMFS 2010a).

The primary threat that exists to bearded seals today is the loss of sea ice habitat as a result of warming climate trends projected through the end of the century (NMFS 2010a).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb seals if they occurred near the West Dock facility on the Beaufort Sea. Disturbance could result in temporary movement away from the vessel, and could also affect diving beneath the water surface and diving into the water if hauled-out on floating ice; however, none of these are considered adverse effects. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. Few, if any, bearded seals would be expected near the dock however; and the likelihood of vessel-related disturbance to bearded seals would be very low to none. The incremental increase in vessel traffic in the Beaufort Sea associated with the proposed Project would be within the range of normal activities currently occurring at West Dock.

Based on the unlikely presence of bearded seals at West Dock during vessel operations, and AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at West Dock, the proposed Project would not likely adversely affect bearded seals.

5.8.5.2 Bowhead Whale

Affected Environment

The bowhead whale was federally listed as endangered in June 1970 (35 FR 106:8491). No critical habitat has been designated. The Western Arctic stock of the bowhead whale is considered by NMFS as a strategic stock and is the only stock present in U.S. waters. The Western Arctic stock occurs in the proposed Project area during spring and fall migrations through the Beaufort Sea. Bowhead whales are large, filter feeding or baleen whales that are an important subsistence resource. They feed almost exclusively on zooplankton, which includes small to moderately sized crustaceans such as copepods, euphausiids, and mysids, as well as other invertebrates and fish (NOAA 2011). Bowhead whales reach sexual maturity at about the age of 20 years and females generally have one calf every 3 to 4 years (NOAA 2011). They migrate through the Beaufort Sea using openings, or lead systems, in the sea ice that form offshore of the barrier islands. They arrive on their summering grounds near Banks Island, Canada during mid-May to June (IWC 2005). Bowhead whales migrate back through the Alaska Beaufort Sea in August and September and are present in the Central Beaufort and Prudhoe Bay area from late August through late October (Moore and Reeves 1993).

Acoustic monitoring indicates that over 95 percent of the bowhead whales recorded during fall surveys at the Northstar Facility just offshore of West Dock occurred an average of about 11 miles offshore (Blackwell et al. 2007). West Dock extends out from the shoreline a total distance of 2.7 miles to water depths of 7 feet. The occurrence of bowhead whales in the proposed Project area is therefore highly unlikely. Most bowheads of the Western Arctic stock overwinter and congregate prior to migration in association with polynyas and the marginal ice zone in the central and western Bering Sea (Moore and Reeves 1993). Most calving occurs from late March to mid-June in the Chukchi Sea. There are an estimated 10,545 bowhead whales in the Western Arctic stock (Angliss and Outlaw 2008) that may occur within the proposed Project area. The Western Arctic stock of bowhead whales increased at an annual rate of 3.4 percent between 1978 and 2001 (George et al. 2004). See Figure 5.7-1 Marine Mammal Section for Bowhead whale habitat near West Dock.

Recent actions that have affected the bowhead whale include historic commercial whaling, subsistence hunting, oil and gas-related activities, non-oil and gas industrial development, research activities, marine vessel traffic and commercial fishing, pollution and contaminants baseline, and climate change. However, other than historic commercial whaling, there is little evidence that previous or current human activity has negatively affected bowhead whales or prevented their recovery (NMFS 2008b).

Environmental Consequences

<u>Proposed Action</u>

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb bowhead whales if they occurred near the West Dock facility on the Beaufort Sea. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away, though a bowhead whale may begin swimming away at a further distance from the vessel than either fin or humpback whales. Bowhead avoidance of a vessel may begin at 0.6 to 2.5 miles (Minerals Management Service 2009a). After the disturbance has passed, bowhead whales would resume feeding or other behaviors within minutes to hours and displacement from the area would be short-term (Minerals Management Service 2009b). Bowhead whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies, which could disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and as such, would have little impact on bowhead whales. Cargo vessels and barges would travel at low rates of speed and are not likely to collide with bowhead whales. The potential for an oil spill could occur if a vessel went aground; however, would be unlikely. However, few, if any, bowhead whales would be expected near West Dock, and the likelihood of vessel-related disturbance to bowhead whales would be very low.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at West Dock. Based on the unlikely presence of bowhead whales at or near West Dock during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS or applicable subsistence avoidance measures for vessel operations at West Dock, the proposed Project may temporarily affect, but would not likely adversely affect bowhead whales.

5.8.5.3 Cook Inlet Beluga Whale

Affected Environment

The DPS of the beluga whale found in Cook Inlet was listed as a depleted stock under the MMPA on May 31, 2000 (65 FR 105:34590) and as endangered under the ESA on October 22, 2008 (73 FR 205:62919) (NMFS 2008a). Critical habitat has been designated within Cook Inlet; excluding the area around the POA (76 FR 69:20180). See Figure 5.7-2 in the Marine Mammal Section (5.7) for Cook Inlet beluga whale habitat.

Beluga whales are about 12 to 13 feet long, dark gray at birth and white in adulthood. Calves are born in the summer and beluga whales typically care for their calves for about 2 years. Beluga whales are opportunistic feeders and prey upon a variety of fish and invertebrates depending on their availability during the whale's seasonal movements between the upper and lower Cook Inlet. Beluga whales commonly use waters near the POA. During late fall, beluga whales concentrate at the mouth of Ship Creek, commonly within 300 feet of the docks at the POA as they forage for salmon (Port of Anchorage 2009). Beluga whales follow the tidal influx and outflux close to the POA in October and November (Cornick and Saxon-Kendall 2009). Recent actions that may have affected the Cook Inlet beluga whale include subsistence hunting, oil and gas-related activity, non-oil and gas industrial development, research activities, marine vessel traffic, commercial fishing, pollution and contaminants, and climate change.

Environmental Consequences

<u>Proposed Action</u>

The POS was selected as the planned port of entry for pipe and equipment due to available storage and connection to the Alaska Railroad Corporation (ARRC) railroad (AGDC 2011a). However, if barges are needed for the proposed Project for delivery of materials to the POA, vessel traffic could disturb Cook Inlet beluga whales. Disturbance could result in temporary movement away from the vessel and port facilities. Noise from vessels at the POA could interfere with behavior and communications by masking natural sounds or calls from other beluga whales; however, most engine noise from vessels that would typically occur (5-500 Hz) is at frequencies below those used by beluga whales (10 to 100 kHz) (Blackwell and Greene 2002). Noise produced from vessel activity would be temporary, limited to the proximity of the vessel, and would not likely adversely affect beluga whales. Cargo vessels and barges travel at low speeds in a linear and consistent movement pattern with minimal course changes. Vessels and barges would not likely cause a collision but could result in a low level of disturbance to beluga whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. Alteration of salmon streams due to construction of the pipeline through upper Cook Inlet drainages could reduce the amount of prey available for beluga whales; especially alterations to the Susitna River. However, the proposed Project would comply with best management practices (BMPs) and mitigation (see Section 5.23, Mitigation) for stream crossing construction impacts and is not likely to result in reductions of salmon or the in-stream habitats upon which they rely.

The incremental vessel traffic associated with the proposed Project would be within the range of normal activities occurring at the POA. Based on this and the AGDC's commitment to comply with recommendations from the NMFS/USFWS, the proposed Project may temporarily affect, but would not likely adversely affect Cook Inlet beluga whales. The proposed Project would not adversely modify Cook Inlet beluga whale critical habitat.

5.8.5.4 Fin Whale

Affected Environment

The fin whale was federally listed as endangered in June 1970 (35 FR 106:8491). No critical habitat has been designated. The Alaska stock of fin whales can be found in the deep waters of the Bering Sea and the Gulf of Alaska. The highest densities of Alaska stock fin whales can be found in the northern part of the Gulf of Alaska and southeastern part of the Bering Sea between late spring through early fall (May through October) (NMFS 2008b). Fin whales do not commonly occur in upper Cook Inlet. Fin whales feed primarily on krill or euphausiids, as well as substantial quantities of fish (NMFS 2008b). After 11-12 months of gestation, females give birth to a single calf in tropical and subtropical areas during midwinter (NOAA 2011). The North Pacific population of fin whales is estimated at 15,000 whales (Angliss et al. 2001) and the population of fin whales present in Alaskan waters west of Kodiak Island is estimated at a minimum of 5,700 (Angliss and Allen 2009). See Figure 5.7-2 in Section 5.7, Marine Mammals for fin whale habitat.

Recent actions that are assumed to have effects on fin whales include historic commercial whaling, subsistence hunting, oil and gas-related activity, non-oil and gas industrial development, research activities, marine vessel traffic and commercial fishing. However, other than historic commercial whaling, there is little evidence that previous or current human activity has negatively affected fin whale populations (NMFS 2008b).

Environmental Consequences

Proposed Action

Vessels associated with delivery of materials and supplies to Seward could disturb fin whales if they occurred near the POS. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away and fin whales may begin avoiding vessels from 1.2 to 2.5 away (Minerals Management Service 2009a). After the disturbance has passed, fin whales would resume feeding or other behaviors within minutes to hours and displacement from the area would be of short-duration (Minerals Management Service 2009b). Fin whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies, which can disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and would have little impact on fin whales. Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and would not likely collide with fin whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. Few, if any, fin whales would be expected near Seward, and the likelihood of vessel-related disturbance to fin whales would be very low.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at the POS. Based on the unlikely presence of fin whales at or near the POS during vessel operation and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at the POS, the proposed Project would not likely adversely affect fin whales.

5.8.5.5 Humpback Whale

Affected Environment

The humpback whale was federally listed as endangered in July 1970 (35 FR 106:8491). No critical habitat has been designated for the humpback whale. The Central North Pacific and Western North Pacific stocks could occur within the proposed Project area. Humpback whales feed primarily on small schooling fish and large zooplankton, mainly krill. Feeding occurs almost entirely in the summer range. Alaskan humpback whales are seasonal migrants and are found in the southeastern area of the state and north and west through the Gulf of Alaska, Bering Sea, and into the southern Chukchi Sea. Most of the humpback whales that summer in

Alaskan waters are thought to winter in the wintering grounds surrounding the Hawaiian Islands. Humpback whales are frequently observed in the lower Cook Inlet south of the Forelands from May to September (Minerals Management Service 1995), but only rarely occur in upper Cook Inlet or the Anchorage area. Humpback whales frequent the Gulf of Alaska and lower Resurrection Bay where they have become habituated to vessel traffic, but they are not expected to occur near the POS. The North Pacific population is currently estimated to be 12,000 whales. The Western Pacific population was last estimated at 394 individuals (Calambokidis et al. 1997); however, this count may be an underestimate because of low sampling effort (Angliss and Allen 2009). See Figure 5.7-1 and 5.7-2 in Section 5.7, Marine Mammals for humpback whale habitat.

Offshore oil and gas activities such as seismic noise that occurs in Australia (University of Queensland 2011) and West Africa has been known to affect humpback whales communication. Increased sighting of humpbacks are occurring in the northern Chuckchi Sea. Recent actions that are known to have affected humpback whales include historic commercial whaling, subsistence hunting, oil and gas related activity, nonoil and gas industrial development, research activities, marine vessel traffic, and commercial fishing. Other than historic commercial whaling, however, there is little evidence the previous or current human activity has negatively affected humpback whale populations (NMFS 2008b).

Environmental Consequences

Proposed Action

Vessels associated with delivery of materials and supplies that would be delivered to Seward or Anchorage could disturb humpback whales if they occurred near the POS or the POA. Disturbance could result in temporary movement away from the vessel. The typical reaction of a baleen whale to a vessel is to swim away and humpback whale avoidance may begin at 1.2 to 2.5 miles from the vessel (Minerals Management Service 2009a). After the disturbance has passed, humpback whales would resume feeding or other behavior usually within minutes or hours and displacement from the area would be short in duration (Minerals Management Service 2009b). Humpback whales in the vicinity of a transiting vessel are expected to slightly change their swimming speed and direction in an effort to avoid closely approaching the vessel or noise source. Engine noise from vessels may mask whale calls if they occur in similar frequencies, which can disrupt communication among whales. Any noise effects would be temporary, limited to the proximity of the vessel, and would have little impact on humpback whales. Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and are not likely to collide with humpback whales. Humpback whales would be expected to occur near Seward and the lower portions of Cook Inlet and Project-related vessel traffic would be likely to encounter humpback whales. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal shipping activities currently occurring at the POS and the POA. Based on the likely presence of humpback whales near the POS during vessel operations, and the

AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operations at the POS and the POA, the proposed Project may temporarily affect, but would not likely adversely affect the humpback whale.

5.8.5.6 Pacific Walrus

Affected Environment

The Pacific walrus was determined to warrant protection as threatened or endangered under the ESA on September 10, 2009 (74 FR 174:46548), but was precluded from listing because of higher priority species and became a federal candidate species on February 10, 2011 (76 FR 28:7634). No critical habitat has been designated for the Pacific walrus. The Pacific walrus is distributed over continental shelf waters in the Chukchi and Bering seas, ranging from the eastern East Siberian Sea to the western Beaufort Sea. Walruses feed most frequently on benthic clams, snails, and polychaete worms and prefer to forage in areas less than 262-feet-deep (Fay 1982). Pacific walruses depend on sea ice for breeding, calving, and haul out near foraging habitats. Low numbers of Pacific walrus occur in the Beaufort Sea and while some walruses have hauled-out onshore near Kaktovik (which indicates travel past the West Dock area), this is an infrequent event and walrus rarely occur in the Prudhoe Bay region (USFWS 2010a). The potential for an oil spill exists if a vessel went aground, although such an occurrence is unlikely. See Figure 5.7-4 in Section 5.7, Marine Mammals for Pacific walrus habitat.

Recent actions that may have affected the Pacific walrus include historic commercial harvest, subsistence hunting, human disturbance to land-based haul-out areas, and climate change resulting in increased land-based haul out behavior. Projected loss of sea ice due to climate change and associated effects are considered a current threat to the Pacific walrus population. The largest changes in sea ice distribution and resulting walrus distribution are expected to occur in summer (June through August) and fall (October through November).

Environmental Consequences

<u>Proposed Action</u>

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb Pacific walruses if they occurred near the West Dock facility. Disturbance could result in temporary movement away from the vessel, as well as affect diving beneath the water surface and into the water if hauled-out on floating ice. However, none of these temporary effects are considered adverse. Few, if any, Pacific walruses would be expected near the dock, and the likelihood of vessel-related disturbance would be very low to none. The incremental increase in vessel traffic associated with the 2 year construction period for the proposed Project would be within the range of normal activities currently occurring at West Dock.

Proposed Project development would not increase air traffic use over the Beaufort Sea, which could potentially affect areas used for haul out locations in the future for Pacific walrus. Based on the unlikely presence of Pacific walruses at West Dock during vessel operations, and the AGDC's commitment to comply with recommendations from the NMFS/USFWS for vessel operation at West Dock, the proposed Project would not likely adversely affect the Pacific walrus.

5.8.5.7 Polar Bear

Affected Environment

The polar bear was federally listed as threatened in May 2008 (73 FR 95:28212). Critical habitat was designated for the polar bear in December 2010 (Lentfer and Hesel 1980). The three units designated as critical habitat for polar bear populations in the United States include: sea-ice habitat, terrestrial denning habitat, and barrier island habitat (Lentfer and Hesel 1980). All three of these units occur within the proposed Project area.

Polar bears are large white to yellow bears with black skin that occur throughout the ice-covered waters of the circumpolar Arctic. An estimated 1,500 polar bears occur in the Southern Beaufort Sea polar bear population (73 FR 95:28212). This population is considered to be declining and is predicted to continue to decline because of declining sea ice habitat (73 FR 95:28212).

In Alaska, polar bears remain on sea ice year-round over most of their range, although their distribution varies seasonally with the seasonal extent of sea ice cover and availability of prey (primarily ringed seals and bearded seals). In the fall, when the annual sea ice begins to form in the shallower water over the continental shelf, polar bears that had retreated north of the continental shelf during the summer return to the shallower shelf waters where seal densities are higher (Durner et al. 2009). Polar bears in the southern Beaufort Sea reach their peak weights during the fall and early winter period (Durner and Amstrup 1996). Consequently, the availability and accessibility of prey during this time may be critical for survival through the winter. Polar bears are active all winter moving to adjust to changing sea ice and seal distributions. During the winter period, when energetic demands are the greatest, nearshore lead systems and ephemeral (may close during the winter) or recurrent (open throughout the winter) polynyas (areas of open sea surrounded by sea ice) are important for seals, and are thus important foraging habitat for polar bears (Lentfer and Hesel 1980). Nearshore lead systems and the shore-fast ice zone are important hunting and foraging habitat for polar bears in the spring (Stirling and Derocher 1993).

In Alaska, most land use is by maternal females in dens during the winter. Female bears use dens to give birth. They typically excavate dens in snow in November, give birth in late December, and emerge from their dens in March or April (Ramsay and Stirling 1988). Young bears stay with their mothers until they are weaned at about two years of age, and female bears may reproduce at 3-year intervals. Polar bears may also occur on shore when there is open water during summer and early fall. In recent years, the prolonged open water season has resulted in increased use of terrestrial coastal areas by polar bears for longer durations during the summer and early fall (Schliebe et al. 2008).

In northern Alaska, denning habitat is more diffuse than in other areas such as Wrangel Island (located between the Chukchi Sea and East Siberian Sea) where high-density denning by polar bears has been identified (Amstrup 2003). Polar bears in the Beaufort Sea exhibit fidelity to denning areas but not to specific den sites (Amstrup and Gardner 1994). Barrier islands, river bank drainages, and coastal bluffs that occur at the interface of mainland and marine habitat that are able to accumulate snow in fall and early winter appear to be the preferred topographic features for denning polar bears in Alaska (Durner et al. 2010; Figure 5.8-1). Suitable macrohabitat characteristics of these topographic features were identified in the final critical habitat designation for polar bears (Lentfer and Hesel 1980) and include:

- Steep, stable slopes (mean = 40, SD = 13.5), with heights ranging from 4.3 to 111.6 feet (mean = 17.7 feet, SD = 24.3 feet), and with water or relatively level ground below the slope and relatively flat terrain above the slope;
- Unobstructed, undisturbed access between den sites and the coast; and
- The absence of disturbance from humans and human activities that might attract other polar bears.

Polar bears on land would be most likely to be affected by the proposed Project (i.e., maternal females in dens during the winter or polar bears on shore during open water in the summer and early fall). Typically, polar bears avoid humans. This is demonstrated by the areas where they choose to rest, their den site locations, and their avoidance of snow machines (Anderson and Aars 2008). Polar bears tend to avoid denning in areas where active oil and gas exploration, development, and production activities are occurring (Lentfer and Hesel 1980). However, if predictions of the continued loss of Arctic sea ice due to climate change occur, it is expected that the number of polar bears denning on land in northern Alaska east of Barrow will continue to increase (Schliebe et al. 2008). This is supported by the recent increase in the number of bears using the coastal areas during the summer and early fall in northern Alaska (Schliebe et al. 2008). Polar bears face increasing potential for conflicts with humans in a warming Arctic, as industrial activity expands (Arctic Climate Impact Assessment 2005), longer ice-free periods force polar bears to spend more time on land (Schliebe et al. 2008) and nutritional stress encourages polar bears to seek anthropogenic food sources (Regehr et al. 2007). Increased use of terrestrial environments by polar bears would likely increase bear/human interactions in the future.

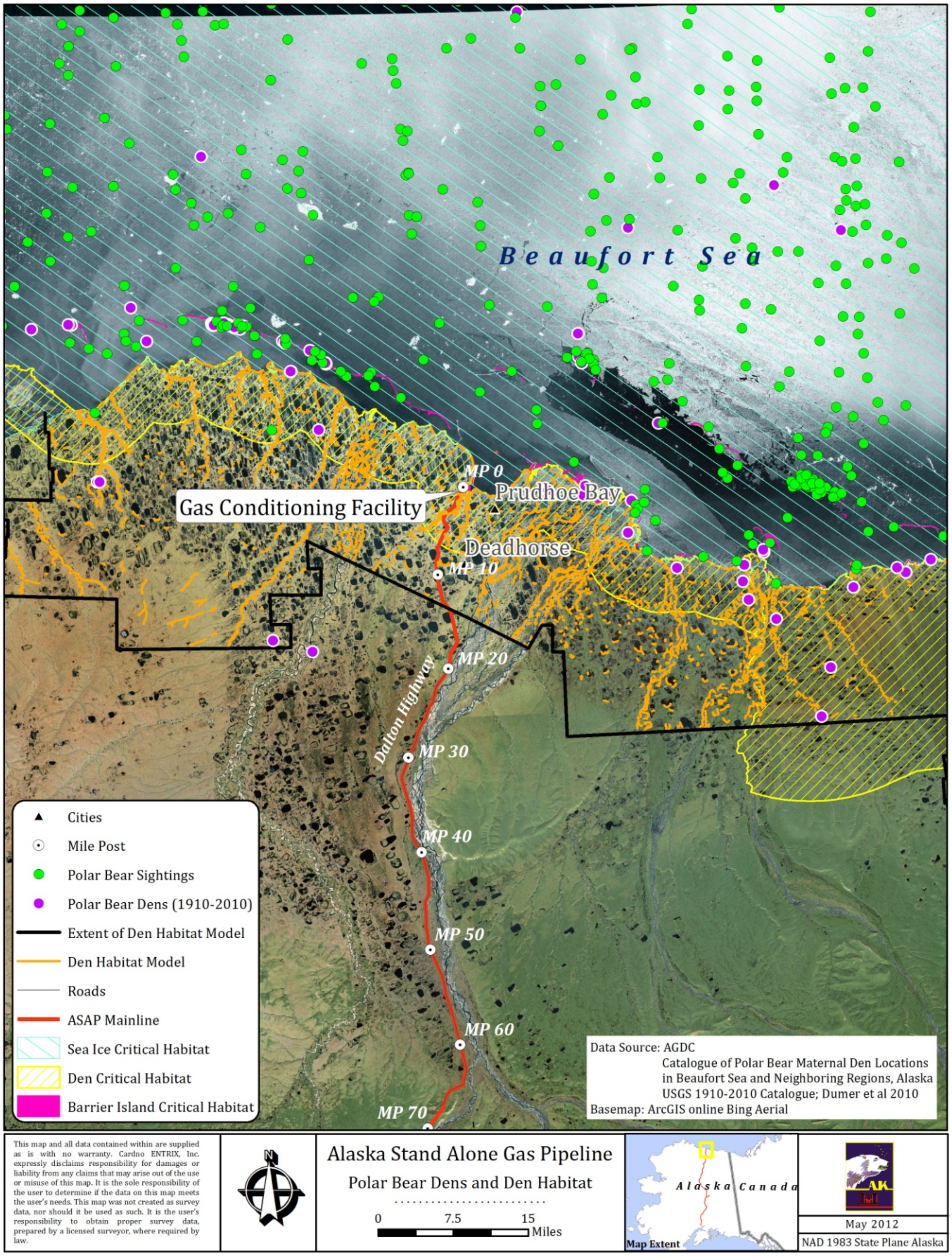

FIGURE 5.8-1 Polar Bear Den Habitat and Historical Den Locations in the Proposed Project Area

Environmental Consequences

Proposed Action

Oil and gas exploration, development, and production, and other associated human disturbance (vessel traffic) are potential sources of harm to polar bears and/or their critical habitat (Lentfer and Hesel 1980). Construction and operation of the GCF and the pipeline on the North Slope may cause disturbance to a few polar bears and potentially their prey (ringed and bearded seal) from increased vessel activity. Expansion of the network of roads, pipelines, well pads, and infrastructure associated with oil and gas activities may affect polar bears by forcing pregnant females into marginal denning locations (Lentfer and Hensel 1980). However, suitable terrestrial denning habitat is not limited on the North Slope.

The proposed Project area would include 55.3 acres of sea ice critical habitat, 16.4 acres of barrier island critical habitat, and 70.3 acres of denning critical habitat for polar bears (Figure 5.8-1; USFWS 2011). The only proposed Project component that would occur within the sea ice and barrier island critical habitats would be the transit of approximately nine vessels in the summer to and from West Dock. The proposed Project would not likely adversely modify or destroy the critical habitat.

Modification to areas of polar bear terrestrial denning critical habitat would occur for the proposed Project. The proposed location for the GCF would be located on flat topography with no ridges or banks that would be likely to support polar bear denning. Stream banks along the Putuligayuk River and tributaries near the proposed GCF location have been identified as containing macrohabitat characteristics described in the final critical habitat designation for denning polar bears (Lentfer and Hesel 1980; Figure 5.8-1). No polar bear dens have been located within the proposed Project area in the past, potentially due to their proximity to human development, which polar bears tend to avoid (Lentfer and Hesel 1980; Figure 5.8-1). As such, no polar bear dens are likely to be disturbed during construction or operation of the GCF or the pipeline. However, if Arctic sea ice loss continues, due to climate change as predicted, it is expected that the number of polar bears denning on land will continue to increase in northern Alaska, east of Barrow (Schliebe et al. 2008). Increased use of terrestrial environments by polar bears combined with the expansion of oil and gas activities on the Alaskan North Slope may cause pregnant female polar bears to den in closer proximity to oil and gas activities in the future. It may also cause increased mortality of polar bears due to defense of life or property (DLP) killings. Polar bears may seek anthropogenic food sources associated with oil and gas facilities as they become nutritionally stressed due to the loss of sea ice.

Oil spills or discharges into the marine environment would also negatively impact polar bears and/or their critical habitat. Food waste, lubrication oils, and antifreeze can be both attractive and toxic to bears. However, all wastes would be contained and disposed of in a manner consistent with BMPs on the North Slope, reducing potential effects.

Polar bears would likely encounter the GCF and pipeline, and potentially project personnel during construction and operations. Regulations for oil and gas operations on Alaska's North Slope pertaining to interactions with polar bears would require that a bear interaction plan be developed and implemented in order to avoid injury to polar bears and humans due to encounters. Based on the presence of a small number of polar bears expected near the proposed Project facilities on the North Slope, a small number of bears would receive incidental "take" interaction from proposed Project activities. No mortality, or injury would likely occur, but temporary deflection and minor changes in bear behavior would be expected to occur primarily during construction activities.

The GCF and the first 6.7 miles of the pipeline would be constructed within designated polar bear terrestrial denning critical habitat. No polar bear dens have been located within the proposed Project area in the past, and the proposed Project footprint does not contain the suitable macrohabitat characteristics for denning sites. Den sites would not likely be chosen in the proposed Project area due to the flat terrain, previous human disturbance, and ongoing oilfield activity. The proposed Project would not likely adversely modify or destroy polar bear critical habitat. The AGDC's commitment to comply with regulations pertaining to polar bears for North Slope oil and gas operations would minimize potential impacts to the polar bear and its critical habitat.

<u>Aboveground and Support Facilities</u>

The only aboveground or support facility that would occur in polar bear habitat is the GCF, which would be built during the first winter of the proposed Project schedule. Polar bears would be more common during the winter than the summer, especially non-denning bears. As noted above, the proposed Project area has not been known to contain any bear dens and the area does not possess preferred den habitat characteristics. Potential impacts to the polar bear from construction of the GCF would include disturbance from noise produced during construction activities. A bear could be startled and run away from the noise if found in the vicinity, or may circumnavigate the area entirely. Polar bears would likely avoid areas with high levels of human activity. During the operations phase of the GCF (up to 50 years), polar bears may spend more time on land as noted above and become associated with anthropogenic food sources, which could result in increased human to bear encounters. DLP killings of polar bears may increase over time if sea ice continues to melt resulting in more polar bears utilizing terrestrial sources for food.

5.8.5.8 Ringed Seal

Affected Environment

The Arctic subspecies of the ringed seal was proposed for listing as a threatened species on December 10, 2010 (75 FR 237:77476). No critical habitat has been designated for the ringed seal. Ringed seals depend on sea ice and excavate subnivean lairs in the snow above holes they maintain in the ice. Pups are born between March and April in the lair, where they remain to nurse for five to eight weeks. Ringed seals forage on arctic cod, saffron cod, shrimp, amphipods, and euphausiids (Reeves et al. 1992). Ringed seals typically remain associated with sea ice throughout the year (Angliss and Allen 2009), although in summer, they are commonly observed alone or in small groups in open water (Harwood and Stirling 1992). Ringed seals are the most frequently observed seals in the Prudhoe Bay region (Simpkins et al.

2003); although large numbers are not expected near West Dock. A minimum estimate of 249,000 Arctic ringed seals are present in the Chukchi and Beaufort Seas (Angliss and Allen 2009); with a recent more comprehensive survey estimated as many as 1,000,000 seals (Kelly et al. 2010). See Figure 5.7-2 in Section 5.7, Marine Mammals for ringed seal habitat.

Recent actions that may have affected ringed seals include pollution and contaminants in the Arctic; subsistence hunting, offshore oil and gas exploration, development and production, and climate change. The primary threat to ringed seals is the loss of sea ice habitat as a result of warming climate trends projected through the end of the century (NMFS 2010b).

Environmental Consequences

Proposed Action

Vessels associated with delivery of modules for the GCF and other materials and supplies that may be delivered to West Dock during the summer months could disturb seals if they occurred near the West Dock facility. Disturbance could result in temporary movement away from the vessel, as well as diving beneath the water surface and into the water if hauled-out on floating ice. However, these effects are all temporary and not considered adverse. Ringed seals would be expected to occur near the dock, although the likelihood of vessel-related disturbance to ringed seals would be low. The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly known as Mineral Management Service (MMS), has previously determined that increased vessel traffic in the Beaufort Sea would have no more than a negligible effect on ice seals (NMFS 2008b). The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal activities currently occurring at West Dock. The potential for an oil spill could occur if a vessel went aground; however, this would be unlikely. Based on the likely presence of ringed seals near West Dock during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operation at West Dock, the proposed Project may temporarily affect, but would not be likely to adversely affect ringed seals.

5.8.5.9 Steller Sea Lion

Affected Environment

The Steller sea lion was protected as a threatened species range-wide in April 1990 because of declining populations. The Western DPS (WDPS) inhabits an area of Alaska from Cape Suckling westward to the end of the Aleutian Island chain and into Russian waters (NOAA 2010a). Because of continual declines, the WDPS was listed as endangered on May 5, 1997 (62 FR 108:30772). Critical habitat has been defined for Steller sea lions as a 20-nautical-mile buffer around all major haul-outs and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas (58 FR 165:45269). Steller sea lions occur throughout the North Pacific Ocean where they use haul-outs and rookeries on beaches (gravel, rocky, or sand), ledges, and rocky reefs (NOAA 2010b). Rookeries are occupied during the May to July breeding season where mating occurs and pups are born; however, Steller sea lions continue to gather at both rookeries and haul-out sites outside of the breeding season

(NMML 2010). Steller sea lions forage near shore and in pelagic waters feeding on a wide variety of fish, mollusks, and squid. Steller sea lions frequently occur at the POS within Resurrection Bay and in the Cook Inlet, and as a result, critical habitat occurs within the proposed Project area. There are approximately 39,000 to 45,000 Steller sea lions in the WDPS. Populations continued to decline at a rate of about 5.4 percent per year between 1991 and 2000 but increased between 2004 and 2008 at a rate of about 1 percent per year (NOAA 2010a). See Figure 5.7-1 and 5.7-2 in Section 5.7, Marine Mammals, for Steller sea lion habitat.

Recent actions that have affected Steller sea lions include pollution and contaminants, subsistence hunting, offshore oil and gas exploration, development and production, climate change, vessel disturbance, and commercial fishing. The primary threats to Steller sea lions are likely competition with commercial fisheries, climate induced changes, and regime shifts in prey availability (NOAA 2010a).

Environmental Consequences

<u>Proposed Action</u>

Vessels associated with delivery of materials and supplies to Seward or Anchorage could disturb Steller sea lions if they occurred near the POS or the POA. Steller sea lion reactions to occasional disturbances range from no reaction to complete and immediate departure from the haul-out area. Low levels of occasional disturbance may have little long-term effect on sea lions (Kenyon and Rice 1961). Cargo vessels and barges would travel at low rates of speed, within shipping lanes, and are not likely to collide with or disturb Steller sea lions. The potential for an oil spill could occur if a vessel went aground in Resurrection Bay; however, this would be unlikely. Steller sea lions would be expected to occur near Seward and the lower portions of Cook Inlet, and Project-related vessel traffic would be likely to encounter Steller sea lions.

The incremental increase in vessel traffic associated with the proposed Project would be within the range of normal shipping activities currently occurring at the POS and the POA. Based on the likely presence of Steller sea lions near the POS during vessel operations, and the AGDC's commitment to comply with any recommendations from the NMFS/USFWS for vessel operation at the POS and the POA, the proposed Project may temporarily affect, but would not likely adversely affect the Steller sea lion.

5.8.5.10 Sea Otter

Affected Environment

The northern sea otter measures approximately 4 feet in length and weighs an average of 65 pounds. The sea otter is a densely furred marine mammal that inhabits the nearshore coastal waters from southeast Alaska to the Aleutian Islands. They primarily inhabit waters approximately 40 meters deep to feed on mollusks and crustaceans in the subtidal and intertidal zone. There are three sea otter stocks in Alaska, which include the southeast, south-central, and southwest stocks. See Figure 5.7-1 and 5.7-2 in Section 5.7, Marine Mammals, for sea otter habitat.

The southwest Alaska DPS of the northern sea otter was listed as threatened on August 9, 2005 (70 FR 152:46366). The USFWS designated critical habitat for this population under the ESA of 1973 as amended on October 8, 2009 (74 FR 194:51988). Approximately 5,855 square miles of marine waters were designated as critical habitat. This area occupies the western side of Cook Inlet to the Aleutian Islands (ADFG 2012). The Southwestern sea otter populations could potentially come in contact with proposed vessel activity, although unlikely, as these stocks reside along the western shore of Cook Inlet outside the proposed Project area.

This south-central stock of sea otter is not ESA listed. The range of the south-central stock includes the area from Cape Yakataga to the eastern half of Cook Inlet along the Gulf of Alaska. The south-central sea otter stock would be the likely stock to coincide with vessel route activity; however, sea otters primarily associate with protected near-shore areas. The range of the southwest Alaska stock includes the western half of Cook Inlet, the Alaska Peninsula and Bristol Bay coasts, Aleutian, Barren, Kodiak and Pribilof Islands. The Northern sea otter is not typically migratory, and can dive up to 330 feet to forage along the sea floor.

Recent potential threats posed to sea otters include oil spills, habitat loss and degradation, disease, food limitation, fishing gear entanglement, and predation. Sea otters reached near extinction levels by the end of the Pacific maritime fur trade in the early 1900s. Populations rebounded until the 1990s when killer whale predation affected the southwest sea otter population decline (58 to 68 percent) (Maldini et al. 2004).

Environmental Consequences

Proposed Action

Vessel activity that would occur in the POS from proposed Project construction activities may cause temporary disturbance to sea otters that inhabit Resurrection Bay near the port. Temporary disturbance would occur from vessel noise and movement, or potentially an oil spill if a vessel went aground. Disturbance from vessel noise could be received from underwater or above water sounds when sea otters are diving, resting, feeding or preening. Temporary displacement from disturbance would result in diving or swimming away from the source of noise and resuming natural behavior when a comfortable distance is reached. It would be unlikely that a spill would occur due to a vessel running aground in Resurrection Bay. Sea otters would be expected to be habituated to the existing regular vessel traffic in Resurrection Bay and the POS. Sea otters primarily inhabit lower Cook Inlet and would not be affected by increased vessel traffic at the POA. The increased vessel traffic at the POS and POA may temporarily affect, but would not be likely to adversely affect sea otters.

5.8.5.11 Eskimo Curlew

Affected Environment

The Eskimo curlew is federally listed (32 FR 48:4001) and state listed in Alaska as endangered (ADFG 2010). The Eskimo curlew is a medium sized (12 inches), cinnamon brown shorebird, with a down-curved bill. The Eskimo curlew was once abundant. Historical accounts indicate flocks of thousands migrated from northern North America to the Argentine pampas, crossing central North America and the Atlantic coast. They bred in Alaska and northern Canada and migrated south through the prairies of the U.S. to the grasslands in South America, spending most of their time in prairies and grasslands along the way (Ambrose 2008b). Currently, the Eskimo curlew is thought to be extinct. The last sighting of an Eskimo curlew was in 1962 on the coast of Texas (Ambrose 2008b). No critical habitat has been designated for the Eskimo curlew.

The primary threat to the Eskimo curlew was un-curtailed hunting by market hunters following the population crash of the passenger pigeon (*Ectopistes migratorius*). In addition to hunting, the conversion of prairies in the central U.S. to cropland and suppression of wildfires resulted in large-scale habitat loss. Cropland was not ideal feeding habitat during migration and suppression of wildfires resulted in succession of prairie grasslands to woodlands.

Environmental Consequences

Proposed Action

The Eskimo curlew is considered to be extinct, and as a result, the proposed Project would have no effect on this species.

5.8.5.12 Spectacled Eider

Affected Environment

Spectacled eiders are large sea ducks (21 inches) with feathering that extends down their bill. Males in breeding plumage during winter and spring have a black chest, white back, and a pale green head with a white spectacle-like patch around the eyes. Females and juveniles are mottled brown with pale brown eye patches. Three distinct breeding populations of the spectacled eider include one in western Alaska on the central Yukon- Delta YK Delta, one on Alaska's Arctic Coastal Plain (ACP), and one in northern Siberia. Spectacled eiders were federally listed as a threatened species throughout their range in May 1993 (58 FR 88:27474) because of a rapid population decline in the population breeding on the YK Delta. Designated critical habitat includes breeding habitat on the YK Delta and marine molting and overwinter habitats in Norton Sound, Ledyard Bay, and the Bering Sea between Saint Lawrence and Saint Matthew Islands (66 FR 25:9146). The proposed Project area does not overlap with Spectacled Eider critical habitat.

No critical habitat for spectacled eiders has been designated on the ACP. Critical habitat was not designated on the coastal plain of the North Slope because habitat, particularly nesting habitat, was not considered to be limiting for this species. Elements of critical habitat that might warrant more scrutiny during oil and gas development include: (1) all deep waterbodies; (2) all waterbodies that are part of basin wetland complexes; (3) all permanently flooded wetlands and waterbodies containing either water sedge (*Carex aquatilis*), Arctic pendant grass (*Arctophila fulva*), or both; (4) all habitats immediately adjacent to these habitat types; and (5) all marine waters out to 25 miles (40 kilometers) from shore, associated aquatic flora and fauna in the water column, and the underlying benthic community (66 FR 25:9146). Many of these elements are found in the proposed Project area.

Recent threats to spectacled eiders include ingestion of contaminants (especially spent lead shot), predation, hunting, ecological effects of commercial fisheries, and complex changes in fish and invertebrate populations in the Bering Sea (65 FR 26:6114) (Sea Duck Joint Venture 2004; USFWS 2001a).

On Alaska's North Slope, nearly all spectacled eiders breed north of 70 degrees latitude between Icy Cape and the Shaviovik River, within about 50 miles of the coast (65 FR 26:6114). Within this region, most spectacled eiders occur between Cape Simpson and the Sagavanirktok River (65 FR 26:6114). The current nesting population is estimated to be between 3,343 and 6,692 spectacled eiders with a significant annual declining trend of 1.5 percent (Larned et al. 2010). In general, very high densities of nesting spectacled eiders occur west of the Sagavanirktok River and are concentrated primarily within the National Petroleum Preserve Alaska (NPRA), with densities between the Shaviovik and Canning rivers ranging from very low to medium (USFWS 2008; Figure 5.8-2).

Spectacled eiders presence in the Beaufort Sea is mainly limited to nearshore waters from May to September. Spring migration in the Beaufort Sea occurs in May and June when many marine birds use the lead system as a migratory pathway to breeding grounds in northern Alaska and the Canadian Arctic (Woodby and Divoky 1982). Molting flocks of spectacled eiders gather in shallow waters off the coast starting with males at the end of June (USFWS 2001a). Females with failed nests leave to molt at sea by mid-August while successful females stay with their young on the nesting grounds until late August to early September when they start their southward migration (USFWS 2001a). Given the relatively low onshore densities of spectacled eiders near the proposed Project area (Figure 5.8-2), densities offshore are expected to be low.

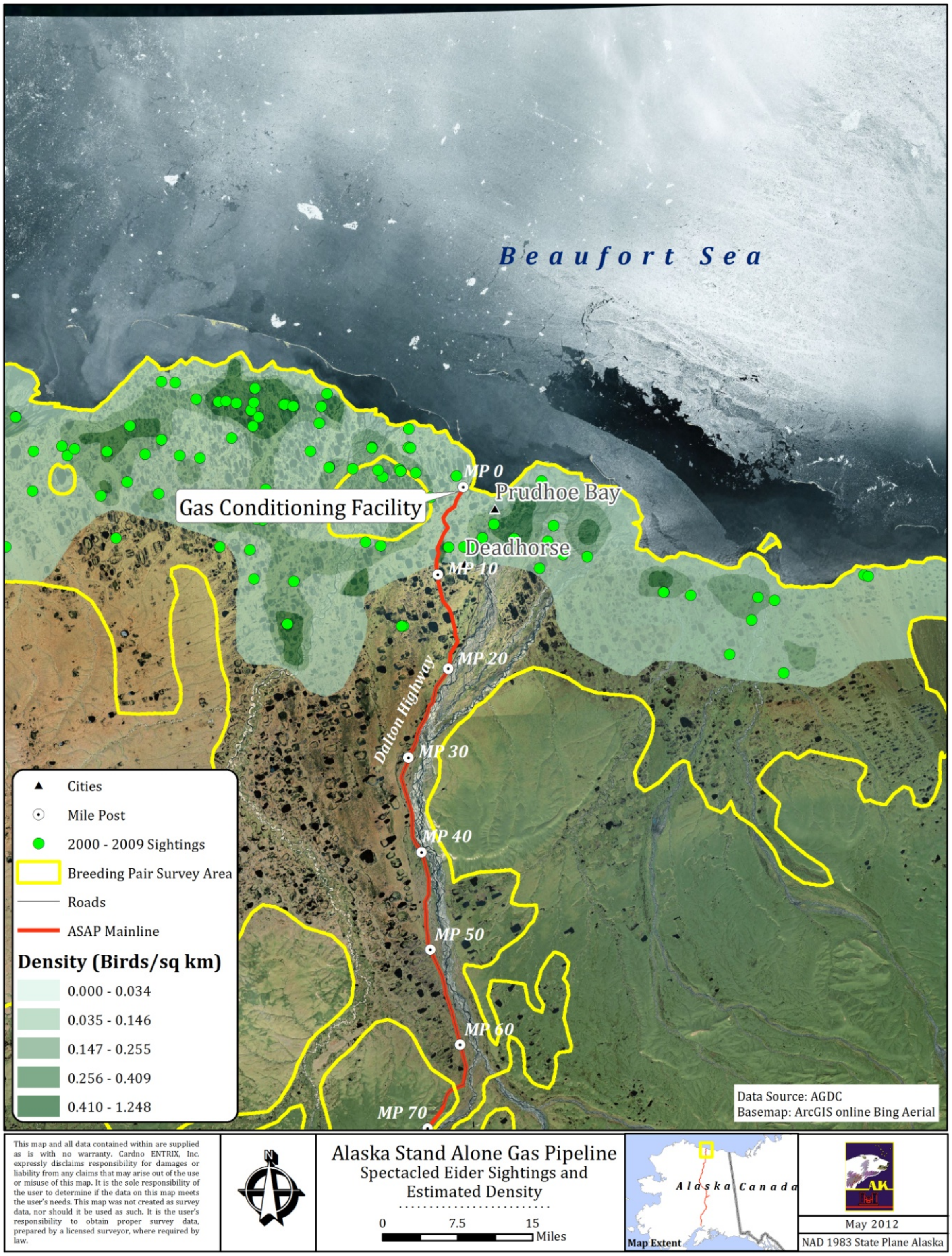

FIGURE 5.8-2 Arctic Coastal Plain Spectacled Eider Breeding Pair Survey Observations and Nesting Density

Environmental Consequences

Proposed Action

At most, 81 acres of potential spectacled eider breeding habitat could be disturbed by the construction of the proposed Project. Up to 72 acres would be permanently lost for the construction of the GCF and the buried and elevated portions of the pipeline. However, habitat loss is not likely to adversely affect spectacled eiders since nesting habitat for spectacled eiders is not limiting on the North Slope of Alaska. Annual USFWS aerial surveys do not indicate that the proposed Project area is heavily used by spectacled eiders (USFWS 2008, Figure 5.8-2) and previous site-specific nesting surveys from 1991 to 1995 do not indicate that breeding pairs of spectacled eiders have used the area of the GCF for nesting (USFWS 2008, Figure 5.8-2; Troy Ecological Research Associates 1996). However, traffic along infield roads between Deadhorse and the GCF would be adjacent to areas used for breeding by spectacled eiders.

Potential disturbance to any nesting spectacled eiders in the proposed Project area would be minimized through construction timing. Construction of the GCF and first 75 miles of the gas pipeline would primarily occur during the winter when spectacled eiders are not present on the North Slope of Alaska. However, some construction staging activities and other site preparation activities and operation and maintenance activities are likely to occur during summer. Summer traffic along infield roads between Deadhorse and the GCF would be in addition to local field traffic. The additional traffic could disrupt breeding activities or collide with eiders or their young. To minimize potential traffic incidents, vehicles would be required to comply with existing speed limits and all activities associated with the proposed Project would comply with North Slope environmental standards and practices.

Birds can be negatively impacted by noise, especially during the nesting season when they may be restricted to one site for up to four weeks (Drewitt and Langston 2006). Increased noise at the Central Compressor Plant in the Prudhoe Bay oil field caused spectacled eiders to shift their distribution (averaging 1,600 feet to 2,000 feet) away from habitats close to the compressor plant (Anderson et al. 1992). However, noise associated with the GCF is not likely to disturb nesting spectacled eiders as they are not anticipated to nest in the immediate vicinity. Even if spectacled eiders were to nest near the GCF in the future, noise levels at the GCF are anticipated to be low because equipment would be housed within the facility and fitted with sound baffles to minimize noise generation.

Increased predator populations in the vicinity of oil field developments have likely increased predation on bird populations (Liebezeit et al. 2009). Increased human activity from the operation of the GCF may attract predators such as Arctic foxes, gulls, and ravens. Currently, facilities near the proposed Project area in Prudhoe Bay adhere to strict protocols to minimize waste that may attract predators and monitor areas that provide nesting habitat. The proposed GCF would operate under these protocols and workers would be trained to remain in compliance to ensure that operation and maintenance activities that increase human activity at the GCF and along the pipeline are not likely to adversely affect spectacled eiders.

Occasionally eiders collide with structures and vessels during migration, especially along the coast and during periods of poor weather and visibility (USFWS 2010b). The location of the proposed Project near the west shore of Prudhoe Bay is not likely to create an additional collision hazard for migrating eiders compared to coastal and nearshore structures such as the Endicott and North Star developments. Approximately nine vessels would be needed to transport materials and equipment for construction of the GCF to West Dock at Prudhoe Bay during the open water season. Eiders are thought to be susceptible to collision with human-made structures including vessels, because they fly low and rapid over the water while migrating and are attracted to bright commercial lights on platforms, boats and construction areas at night (USFWS 2010b). Certain types of lights, such as steady-state red, on structures increase collision risk, particularly in poor weather (USFWS 2010b). In an effort to reduce collision risks resulting from bird attraction to lighted structures, the Bureau of Ocean and Energy Management (BOEM) requires that vessels in the Chukchi and Beaufort Sea program areas minimize the use of high-intensity work lights especially within the 65-foot bathymetric contour (BOEMRE 2011).

Based on the existing information on spectacled eider nest distribution and near-shore habitat use within the proposed Project area, the proposed Project may adversely affect spectacled eiders. However, the completion of site specific nest searches near the proposed GCF, the timing of construction activities during winter for the first 75 miles of the proposed Project, the AGDC's commitment to comply with North Slope environmental standards and practices, and coordination with the USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea would minimize impacts to spectacled eiders. Additional mitigation measures could be required after consultation between the AGDC and appropriate agencies (Section 5.23, Mitigation).

Aboveground and Support Facilities

The only aboveground or support facility that may affect spectacled eiders is the GCF. The impacts noted above including noise production, increased mortality from collisions, predation and a loss of breeding habitat would apply to construction and operation of the GCF. These impacts are not likely to adversely affect spectacled eiders.

5.8.5.13 Steller's Eider

Affected Environment

The Alaska breeding population of the Steller's eider was federally listed as threatened in June 1997 (62 FR 112:31748) due to a contraction of its range on both the YK Delta and on the ACP (USFWS 2002). Designated critical habitat includes breeding habitat on the YK Delta and marine molting and overwinter habitats in the Kuskokwim Shoals in northern Kuskokwim Bay, and Seal Islands, Nelson Lagoon, and Izembek Lagoon on the north side of the Alaska Peninsula (66 FR 23:8850). No critical habitat for Steller's eiders has been designated on the ACP. Steller's eiders are medium-large sea ducks (17 inches) with a squared head and angular bill. Males in breeding plumage have a black back, white shoulders, chestnut breast and belly, a white head with a greenish tuft, and black eye patch. Females are mottled dark red-brown with a lighter eye ring. Both male and female have a blue patch with a white border on the upper wing.

Steller's eiders nest on coastal tundra next to ponds or in drained lake basins. Most nests are found within partially drained lake basins that contain a mosaic of shallow ponds in emergent sedge and pendant grass (65 FR 49:13262). Steller's eiders breeding in Alaska and Russia migrate south after breeding to molt along the coast of Alaska from Nunivak Island to Cold Bay, in Izembek Lagoon, Nelson Lagoon, and near the Seal Islands (USFWS 2002). Steller's eiders are typically associated with the near-shore environment, in protected waters generally less than 33 feet in depth (Larned 2006).

The Alaska breeding population of Steller's eiders is estimated at hundreds or low thousands (Larned et al. 2010; Sea Duck Joint Venture 2003; USFWS 2002). Steller's eiders occur at low densities across the ACP, although they are much more abundant near Barrow (Figure 5.8-3). Historical records document Steller's eiders nesting as far east as Wainwright, although nesting has not been verified east of the Colville River since the 1970s. The Barrow area appears to be the center of abundance and primary nesting area (Quakenbush et al. 2002; USFWS 2002).

Non-breeding and post-breeding eiders in Alaska use the near-shore area of the northeastern Chukchi Sea and large lakes around Barrow for summering and molting, with a few birds occasionally occurring as far east as the U.S.—Canadian Border (Quakenbush et al. 2002; USFWS 2002). Documented sightings of Steller's eiders offshore in the Beaufort Sea are few. In the Beaufort Sea, only three were seen during offshore aerial surveys in 1999-2000 approximately 50 miles southeast of Barrow (Fischer and Larned 2004). As sea ice forms in the Arctic Ocean, flocks move south through open leads and eventually arrive at molting and wintering grounds in ice-free lagoons along the north and south side of the Alaska Peninsula, Cook Inlet, and the eastern Aleutian Islands (BOEMRE 2011).

The cause of the world-wide decline of Steller's eiders remains unknown (USFWS 2001b, 2002). Identified threats to their continued survival include predation, hunting, ingestion of spent lead shot in wetlands, changes in the marine environment, and exposure to oil or other contaminants near fish processing facilities in southwest Alaska (USFWS 2001b, 2002).

Open-cut crossings could impact fish resources by increasing sediment loads downstream during and shortly after the period of construction. Wet open-cut methods would most likely have the largest sediment loads and corresponding impacts to fish resources. The benefits of the open-cut method include low construction cost and short completion time. The primary disadvantages include increased sedimentation and erosion of the stream bank, loss of riparian vegetation, and greater alteration to channel morphology than what occurs with other stream crossing methods.

The dry open-cut method may reduce direct impacts to fish during construction compared to other methods, but fish habitat would be altered the same as noted above. Trenching, even under dry conditions, may reduce the productivity of streams by altering the habitat and substrate characteristics of the stream bank and channel (Fisheries and Oceans Canada 2007).

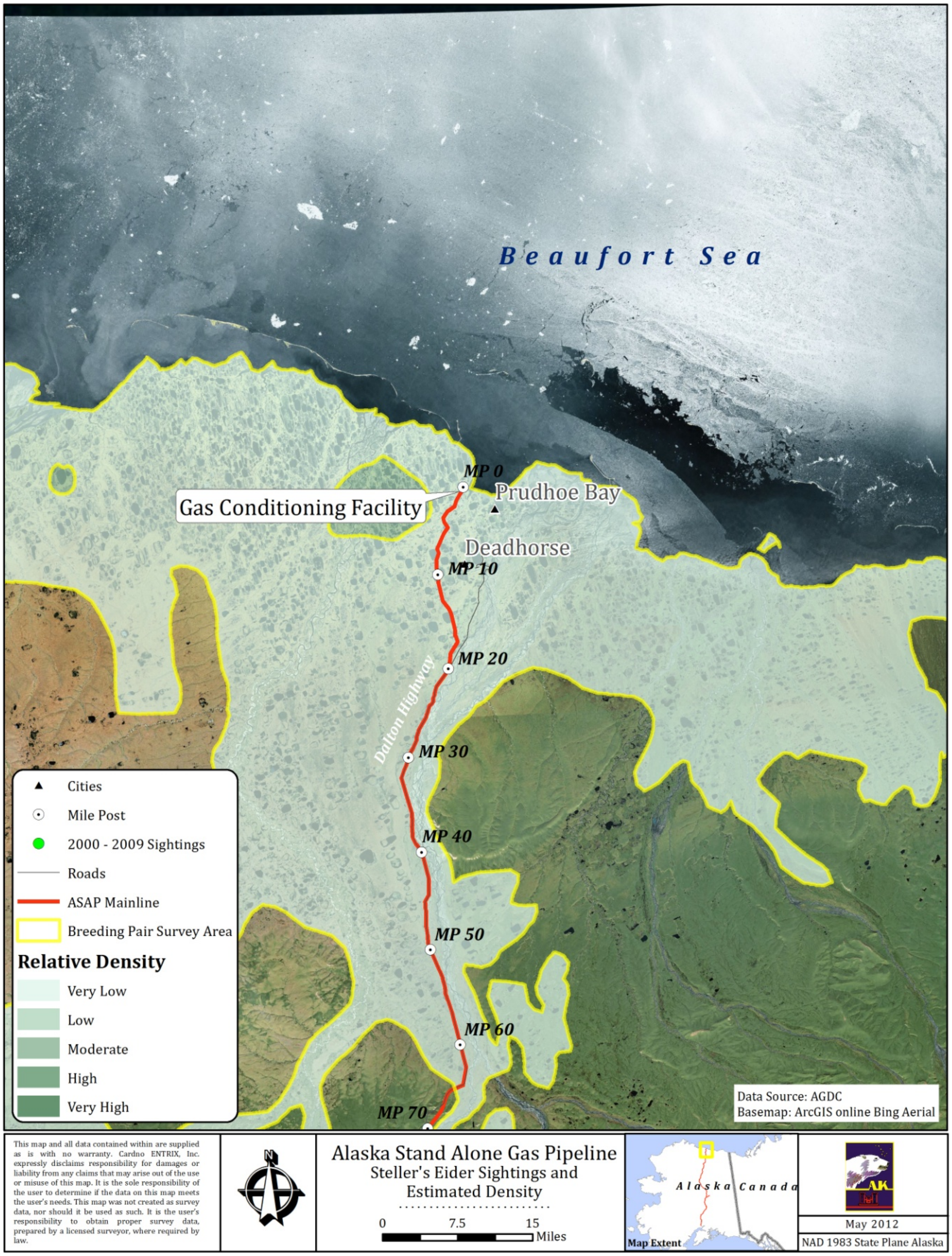

FIGURE 5.8-3 Arctic Coastal Plain Steller's Eider Breeding Pair Survey Observations and Nesting Density

Trenching may also alter stream hydrology by causing the proportion of surface and subsurface flows to shift (Fisheries and Oceans Canada 2007).

Environmental Consequences

Proposed Action

Because no Steller's eiders have been verified nesting east of the Colville River since the 1970s, the proposed Project is not anticipated to disturb nesting Steller's eiders or their nesting habitat (Figure 5.8-3). However, eiders do occasionally collide with structures, including vessels, during migration. Collisions are more likely to occur along the coast and during periods of poor weather and visibility because they fly low and rapid over the water while migrating and become attracted to bright lights at night (USFWS 2010). Certain types of lights, such as steady-state red, on structures increase collision risk, particularly in poor weather (USFWS 2010). In an effort to reduce collision risks resulting from bird attraction to lighted structures, the BOEM requires that vessels in the Chukchi and Beaufort Sea program areas minimize the use of high-intensity work lights, especially within the 65-foot bathymetric contour (USFWS 2010). Approximately nine ships would be needed to ship materials and equipment for construction of the GCF to West Dock at Prudhoe Bay during the open water season. Steller's eiders could potentially collide with the GCF or vessels en route to or from West Dock during spring and fall migration; however, because few Steller's eiders are expected to occur east of the proposed Project area, the potential for collision in or along the Beaufort Sea is very small.

Based on the existing information of Steller's eider nest distribution occurring outside of the proposed Project area and their near-shore marine habitat use in the Beaufort Sea, the proposed Project may temporarily affect, but is not likely to adversely affect Steller's eiders. The nine shipments of material to West Dock are not expected to adversely affect Steller's eiders use of near-shore habitat. Near-shore habitat use for Steller's eiders is outside of vessel shipping lanes to West Dock. Steller's eider would likely be habituated to the regular vessel traffic use at West Dock. The timing of construction activities during winter for the GCF and the first 75 miles of the proposed Project, the AGDC's commitment to comply with North Slope environmental standards and practices, and coordination with the USFWS regarding lighting of vessels and structures in or along the coastline of the Beaufort Sea would minimize impacts to Steller's eiders.

Aboveground and Support Facilities

Construction and operation of the GCF could potentially affect Steller's eiders; however, no Steller's eiders have been verified nesting east of the Colville River since the 1970s. Steller's eiders could potentially collide with the GCF during spring and fall migration, although a minimal number of eiders are expected to occur east of the proposed Project area. As a result, the potential for collision is very small. All other aboveground or support facilities would occur outside of the current distribution of Steller's eiders. Aboveground and support facilities for the proposed Project would therefore have no affect on Steller's eider nesting habitat or to nesting Steller's eiders.

5.8.5.14 Yellow-billed Loon

Affected Environment

The yellow-billed loon, the largest of the three loons occurring on Alaska's ACP, was designated a candidate for federal listing throughout its range in March 2009 (74 FR 56:12932). Yellow-billed loons are considered vulnerable due to their low total population size, low reproductive rate, and specific breeding habitat requirements (Earnst 2004). Yellow-billed loons nest exclusively in coastal and inland low-lying tundra in association with permanent, fish-bearing lakes (74 FR 56:12932). Lakes that are capable of supporting breeding yellow-billed loons contain the following characteristics: abundant fish populations; depths greater than six feet; size of at least 33 acres; connections to streams that supply fish; convoluted, vegetated, and low-lying shorelines; clear water; and stable water levels. Nest sites are usually located on islands, hummocks, or peninsulas, along low shorelines, within three feet of water (74 FR 56:12932). Yellow-billed loons use nearshore and offshore marine waters close to their breeding areas for foraging in summer (74 FR 56:12932).

An estimated 2,944 to 4,194 yellow-billed loons occurred on the ACP in 2009 (Larned et al. 2010). The ten-year population trend for the ACP suggest that this breeding population has increased significantly at a rate of nearly 6 percent per year while the 17-year population trend indicates the population has increased at a rate of 2 percent annually (Larned et al. 2010). Yellow-billed loons occur at low densities across the ACP, although they are much more abundant in the northeastern NPRA west of the proposed Project area (Figure 5.8-4).

Identified recent threats to the yellow-billed loon in Alaska include oil and gas development especially within the NPRA due to breeding habitat loss or degradation (ADFG 2012), marine pollution and overfishing, exposure to contaminants, climate change, subsistence and commercial fishing bycatch (e.g., loons caught in nets), and subsistence harvest (74 FR 56:12932).

Environmental Consequences

Proposed Action

Construction activities for the portion of the pipeline from the GCF to MP 70 could disturb a small number (< 10) nesting yellow-billed loons; although most construction would occur during winter when yellow-billed loons are not present on the North Slope. Noise from operation of the GCF could disturb a minimal number of non-breeding or brood-rearing yellow-billed loons if they use habitats in or near Prudhoe Bay, although noise levels at the GCF are anticipated to be low because equipment would be housed within the facility and fitted with sound baffles to minimize noise generation. Noise associated with the GCF is not likely to disturb nesting yellow-billed loons as they are not anticipated to nest in the vicinity. No recent nest surveys have been completed for the proposed Project area; however, annual USFWS aerial surveys indicate that

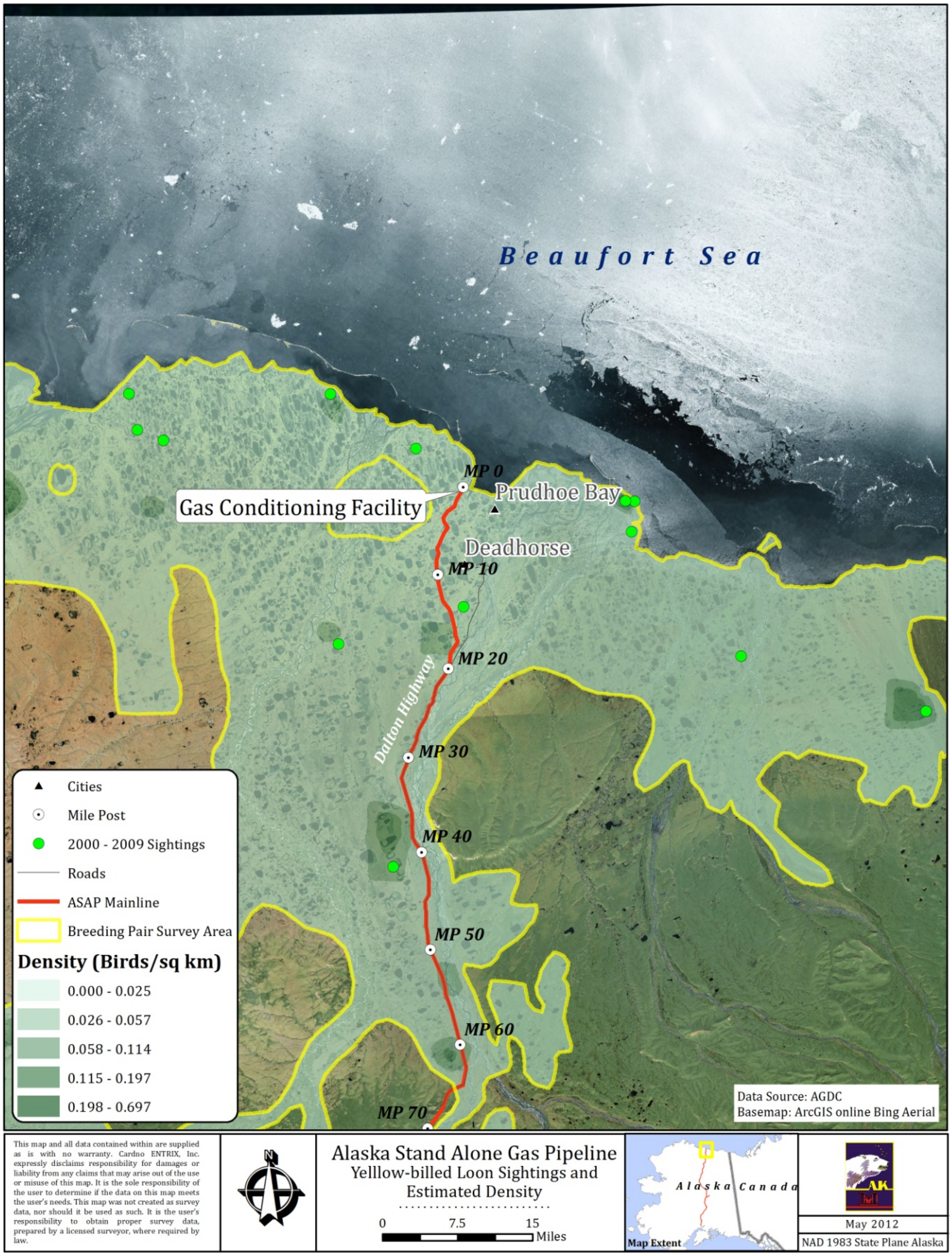

FIGURE 5.8-4 Arctic Coastal Plain Yellow-billed Loon Breeding Pair Survey Observations and Nesting Density

the proposed Project area crosses two lake basins where yellow-billed loons have been observed between 2000 and 2009 (Figure 5.8-4).

Construction traffic along the pipeline route could cross areas used for breeding by yellow-billed loons. Construction traffic in summer would be in addition to local field traffic and the additional traffic could disrupt breeding or foraging activities or collide with loons and their young. Most construction would occur during winter. However, some staging activities and other site preparation activities are likely to occur during summer. To minimize vehicle collision, vehicles would be required to comply with existing speed limits and all activities associated with the proposed Project would comply with North Slope Borough environmental standards and practices. Preconstruction nest survey should be conducted prior to construction to determine site use by breeding yellow-billed loons. Loons occasionally collide with structures during migration, especially along the coast and during periods of poor weather and visibility. The location of the proposed Project near the west shore of Prudhoe Bay is not likely to create an additional collision hazard for migrating loons compared to coastal and near-shore structures.

Existing information indicates that yellow-billed loons may use the proposed Project area for nesting, including the vicinity of the GCF and pipeline within the Prudhoe Bay oil field and south along the Dalton Highway. Site specific nest searches near the proposed GCF and along the pipeline route should be required before project development to prevent disturbance to yellow-billed loons. The AGDC would commit to comply with North Slope environmental standards and practices. As a result the proposed Project would not likely adversely affect yellow-billed loons.

Aboveground and Support Facilities

Construction activities for the GCF may disturb nesting yellow-billed loons, although most construction would occur during winter when yellow-billed loons are not present on the North Slope. Yellow-billed loons may collide with the GCF during migration. However, the GCF is not likely to create an additional collision hazard for migrating yellow-billed loons compared to coastal and near-shore structures. No other aboveground and support facilities occur that would affect yellow-billed loons.

5.8.5.15 State-Protected Animals

The state of Alaska maintains a list of endangered species that are present in Alaska and affords additional protection to these species. The protection afforded to animals and plants on this list are established by Alaska Statute AS 16.20.190 and by the Commissioner of Fish and Game. The short-tailed albatross, Eskimo curlew, blue whale, humpback whale and right whale are listed as state endangered species (ADFG 2012). Table 5.8-2 includes the two state and federally listed species, their status, and their potential to occur within the proposed Project area.

TABLE 5.8-2 Alaska State Endangered Species Potentially Occurring in or near the Proposed Project Area

Species	Group	Status	Occurrence and Habitat	Potential Impacts
Eskimo curlew *Numenius borealis*	Bird – Shorebird	AK-E; ESA-E	Historically nested throughout central and western Alaska; no confirmed sightings of this species since the 1960s and the species is considered extinct.	If species still exists, nesting habitat loss, and disturbance to nest sites
Humpback Whale *Megaptera novaeangliae*	Whale	AK-E; ESA-E	In Alaska, humpback whales are seasonal migrants and are found from southeastern Alaska, north and west through the Gulf of Alaska, Bering Sea, and into the southern Chukchi Sea from May–September.	Disturbance to humpback whales from increased vessel traffic may alter their behavior. Engine noise from vessels may mask whale calls which can disrupt communication among whales.

Sources: ADFG 2012, Ambrose 2008a, Hunt and Eliason 1999, Larned et al. 2010, Swem 2008, Wright et al. 1998, and Wright 2008.

AK-E = Alaska Endangered

ESA-E = Federally Endangered

5.8.6 References

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5.9 LAND USE

This section describes the regulatory setting and the existing land uses, zoning, and land use plans within the proposed Project area. Potential impacts to land use under the proposed Project and the Denali National Park Route Variation are discussed. Land use plans applicable to land intersected by the proposed Project are discussed in this section, including recreation plans; however, effects to the level of recreational use within the proposed Project area are assessed in Section 5.10, Recreation.

5.9.1 Affected Environment

Land management plans and regulations, landownership maps, aerial photography, and other information sources available in the public domain were used to describe the affected environment and to conduct the analysis of potential impacts to land use and ownership under the proposed Project.

5.9.1.1 Regulatory Setting

Federal Regulations

The proposed Project would intersect federal lands managed by the Bureau of Land Management (BLM) and the Department of Defense (USDOD). Portions of the Gas Conditioning Facility (GCF) to milepost (MP) 540 segment would be located in the vicinity of, but would not intersect, lands managed by the U.S. Fish & Wildlife Service (USFWS). One parcel managed by the National Parks Service (NPS) that is adjacent to the Denali National Park and Preserve would be intersected by the GCF to MP 540 segment. The Denali National Park Route Variation would intersect additional land managed by the NPS.

Bureau of Land Management

The BLM administers most of the federal lands in the proposed Project area. Under the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C 1732), the Secretary of the Department of the Interior (DOI) has the authority to regulate use, occupancy and development of public lands and prevent unnecessary or undue degradation of public lands. The BLM, under the authority of the FLPMA, manages approximately 75 million surface acres of federal public land within Alaska through its Fairbanks and Anchorage District offices. Section 503 of FLPMA provides for the designation of right-of-way (ROW) corridors and encourages utilization of ROWs in-common to minimize environmental effects and the proliferation of separate ROWs. BLM policy, as described in Manual 2801.13B1, is to encourage prospective applicants to locate their proposals within corridors. Pursuant to the Mineral Leasing Act (MLA) and 43 Code of Federal Regulations (CFR) 2880, the BLM has the authority to grant a ROW for a natural gas pipeline to cross federal lands under its jurisdiction, or under the jurisdiction of two or more federal agencies, with the exception of lands in the National Park System, Outer Continental Shelf, and Indian Trust lands.

Wilderness Resources Management

The Wilderness Act of 1964 (16 U.S.C 1131-1136, 78 Stat. 890, P.L. 88-57) established the National Wilderness Preservation System and designated the first Wilderness Areas. Seven Wilderness Areas were designated in Alaska by the Alaska Lands Act (P.L. 96-487). The proposed Project would not affect Wilderness Areas in Alaska.

Section 201 of FLPMA requires the BLM to maintain on a continuing basis an inventory of all public lands and their resources and other values. Instruction Memorandum (IM) 2011-154 directs BLM offices to conduct and maintain inventories regarding the presence or absence of wilderness characteristics, and to consider identified lands with wilderness characteristics in land use plans and when analyzing projects under the National Environmental Protection Act (NEPA).

The BLM does not manage any wilderness areas in the State of Alaska. In 1980, the BLM completed a special project Nonwilderness Assessment in Alaska along the Alaska Natural Gas Transportation System route (BLM 1980). As discussed in Appendix J, the 1980 Nonwilderness Assessment shows the area that would also be intersected by the proposed Project ROW lacked naturalness. Recent wilderness inventories have confirmed that the 1980 assessment is still valid and that no other lands meet the criteria for wilderness characteristics. Therefore, BLM-managed lands that would be intersected by the ROW (see Figure 5.9-1) have been determined by the BLM to lack wilderness characteristics and size criteria because of land status and various manmade improvements that affect these criteria (Appendix J).

National Park Service

Lands administered by the NPS in the vicinity of the proposed ROW include the Gates of the Arctic National Park and Preserve (NPP) and Denali National Park and Preserve. The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. The Denali National Park Route Variation would intersect the boundary of the Denali NPP.

In 1980, Congress passed the Alaska National Interest Lands Conservation Act (ANILCA, 16 USC §§ 3101-3233, Pub. L. 96-487), which enlarged and renamed the park as the Denali National Park and Preserve. Section 101 of the ANILCA describes the broad purposes of the new conservation system units (CSUs) throughout Alaska, including the Gates of the Arctic NPP and Denali NPP (NPS 2006). The purpose of the ANILCA includes the following:

- Preserve lands and waters for the benefit, use, education, and inspiration of present and future generations;
- Preserve unrivaled scenic and geological values associated with natural landscapes;
- Maintain sound populations of, and habitat for, wildlife species;
- Preserve extensive, unaltered ecosystems in their natural state;
- Protect resources related to subsistence needs;

- Protect historic and archeological sites;
- Preserve wilderness resource values and related recreational opportunities such as hiking, canoeing, fishing, and sport hunting;
- Maintain opportunities for scientific research in undisturbed ecosystems; and
- Provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so.

Section 202 of the ANILCA states that additions to the Denali NPP are to be managed for the following additional specific purposes:

- To protect and interpret the entire mountain massif and the additional scenic mountain peaks and formations;
- To protect habitat for and populations of fish and wildlife, including, but not limited to, brown/grizzly bears, moose, caribou, Dall sheep, wolves, swans, and other waterfowl; and
- To provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities.

Title XI of ANILCA establishes a comprehensive system for the approval or disapproval of transportation and utility system applications if any portion of the system will be within any conservation system unit, national recreation area, or national conservations area in the state. The Act sets forth criteria for considering the applications, including an assessment of the impacts on fish and wildlife and their habitat (§§ 3161-3173). Transportation systems that are proposed to cross a CSU created or expanded by ANILCA require an act of Congress if such transportation systems would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska.

The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. However, the Denali National Park Route Variation would intersect the boundary of the Denali NPP, including a portion of the Denali NPP designated as wilderness. The requirements of ANILCA Title XI would be complied with if the route through the Denali NPP is determined to be the preferred route.

The portion of the Denali National Park Route Variation that would intersect the boundary of the Denali NPP would be located entirely within the Alaska Department of Transportation & Public Facilities (DOT&PF) ROW. Thus, it would require a permit from Alaska DOT&PF to assure that there are no adverse impacts on the department's use of the ROW. In addition, the NPS must issue a permit for use of the ROW, as the Alaska DOT&PF does not have the authority to issue permits for non-highway transportation.

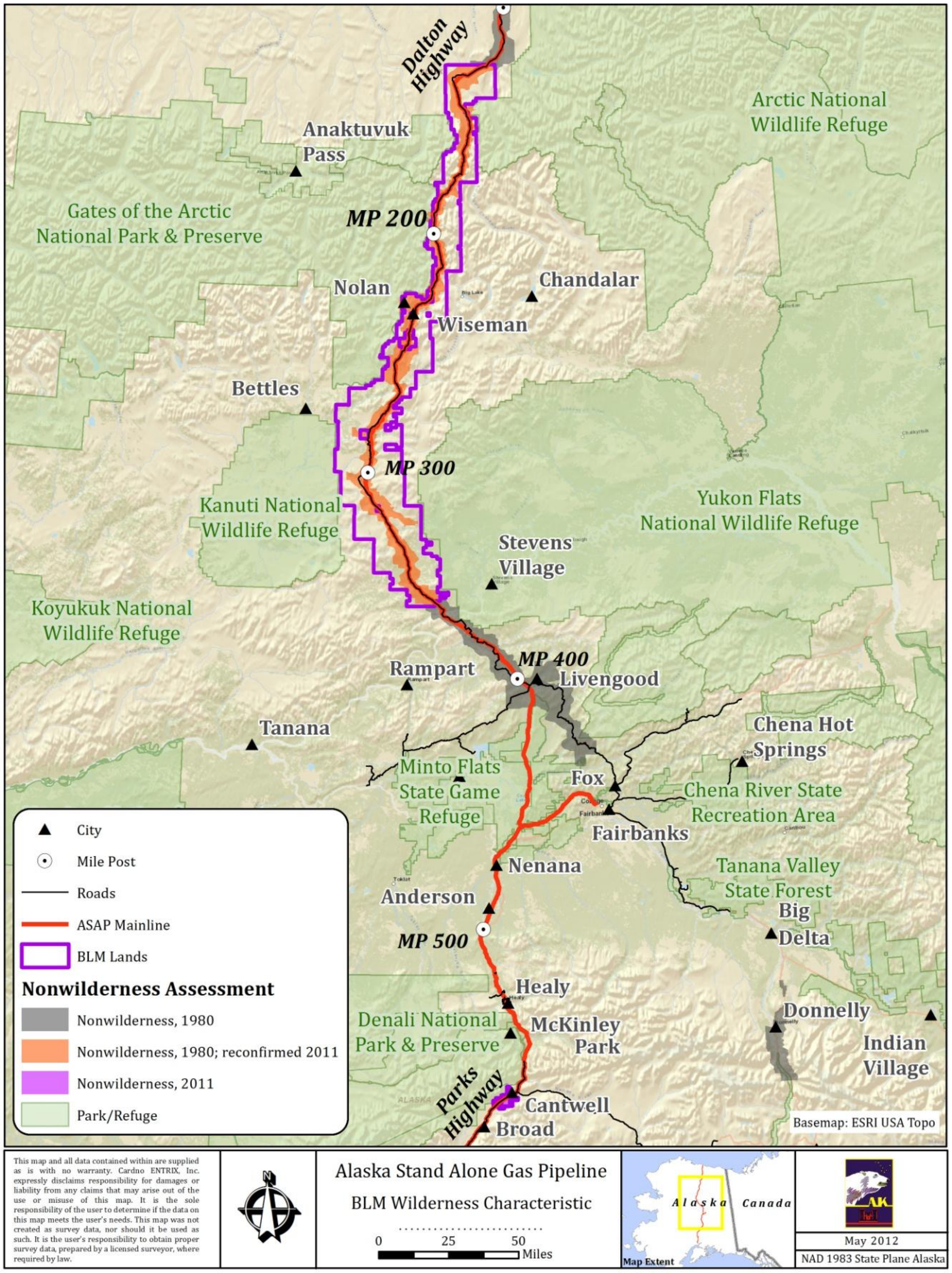

FIGURE 5.9-1 BLM Wilderness Characteristics

Section 6(f) of the Land and Water Conservation Fund

Section 6(f) of the Land and Water Conservation Fund (LWCF; 16 U.S.C 4601 et seq.) applies to public areas that have received LWCF funds to acquire or develop public recreation facilities. Section 6(f)(3) requires these areas be maintained for public outdoor recreation use unless the NPS approves substitute land determined to be of equivalent location, suitability for recreation, and greater or equal to the fair market value of the original property.

This statute would apply to lands that have received LWCF assistance. During scoping of the proposed Project, the NPS identified two Section 6(f) lands potentially crossed by the proposed Project: Denali State Park (SP) and the Nancy Lakes State Recreation Area (SRA). Review of the currently proposed Project alignment and the route alternatives determined that the Nancy Lake SRA would not be crossed and was therefore not evaluated further. However, Denali SP, acquired with the assistance of LWCF funds, would be intersected by the MP 555 to End segment.

Department of Defense

The GCF to MP 540 segment would intersect parcels within the Clear Air Force Station (AFS), which is managed by the USDOD. Clear AFS is located approximately 5 miles south of the city of Anderson and is operated by the 13th Space Warning Squadron (USAF). The AFS uses the Solid State Phased Array Radar System to accomplish the following missions:

- Primary mission: Provide Early Warning of Intercontinental ballistic missiles and Submarine-launched ballistic missiles to the Missile Correlation Center at North American Aerospace Defense Command; and
- Secondary mission: Provide Space Surveillance data on orbiting objects to the Air Force Space Command Space Control Center (Global Security 2005).

For the proposed Project to cross the AFS, the commander of the 13th Space Warning Squadron would have to concur with the BLM in granting a ROW crossing through the AFS.

United States Fish & Wildlife Service

Portions of the GCF to MP 540 segment would be adjacent to, but would not intersect, the Yukon Flats National Wildlife Refuge (NWR) and the Arctic National Wildlife Refuge (ANWR), both of which are administered by the USFWS. The proposed Project would be approximately 0.2 mile or more from either of these areas and neither of these wildlife refuges would be crossed by the proposed Project. Both NWRs are designated as CSUs under ANILCA (see the discussion of CSUs above for the NPS). The proposed Project, however, would not cross either CSU.

The Yukon Flats NWR encompasses approximately 8.5 million acres of federal lands and an additional 2.7 million acres of selected and conveyed lands in Eastcentral Alaska. Congress established the NWR in 1980 when it enacted ANILCA. Section 302(9)(B) of ANILCA sets forth the major purposes for which the Yukon Flats NWR was established and shall be managed. The Yukon Flats NWR was established to conserve canvasbacks and other migratory birds, Dall sheep, bears, moose, wolves, wolverines and other furbearers, caribou, and salmon; to fulfill international treaty obligations; to provide opportunities for continued subsistence uses; and to ensure the necessary water quality and quantity.

When ANWR was established in 1960, its boundaries encompassed 9 million acres. In 1980, ANILCA enlarged the boundaries to over 19 million acres, 8 million acres to be designated as Wilderness, including three Wild Rivers. The purposes for which the ANWR was established and shall be managed, as set forth by Section 303(2)(B) of ANILCA, are identical to those set forth for the Yukon Flats NWR, except that the populations to be conserved within the ANWR vary slightly (caribou herds, polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, snow geese, peregrine falcons, other migratory birds, and Arctic char and grayling).

State Regulations

Alaska Department of Natural Resources

Alaska Statute (AS) 38.04.065 Land Use Planning and Classification and 11 AAC 55.010-.030 requires that the Alaska Department of Natural Resources (ADNR) "shall, with local governmental and public involvement under AS 38.05.945, adopt, maintain, and, when appropriate, revise regional land use plans that provide for the use and management of State of Alaska-owned lands." The Existing Land Use Plans described above state that plans applicable to the study area include: the Dalton Highway Master Plan, Tanana Valley State Forest Plan, North Slope Site Specific Plan (under development), Susitna Area Plan, Southeast Susitna Area Plan, the Public Review Draft Susitna Matanuska Area Plan, the Susitna Basin Recreation Rivers Management Plan, the Tanana Basin Area Plan, Willow Creek State Recreation Area Master Plan, Denali State Park Management Plan, and the Scenic Resources Along the Parks Highway - Inventory and Management Recommendations. Additional information regarding the Scenic Resources along the Parks Highway Inventory and Management Recommendations is included in Section 5.11, Visual Resources.

The ADNR, Division of Mining Lands and Water, manages other state lands for multiple purposes. For those lands that are owned by the ADNR but not covered by a land management plan, the ADNR, in coordination with the public, identifies important land resources and how their lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible multiple uses are allowed on these lands.

Alaska Department of Natural Resources, State Pipeline Coordinator's Office

The AGDC submitted a Right-of-Way Leasing Act AS 38.35.050 Application for Pipeline ROW Lease, which was granted by the State Pipeline Coordinator's Office (SPCO). As described in more detail in Section 1.2.6.4, the ADNR SPCO manages the pipeline ROW and the lands encompassed by the ROW in accordance with the lease for the purposes of construction, operation, maintenance, and termination of a pipeline and all pipeline-associated actions.

Alaska Department of Fish & Game

The mission statement of the Alaska Department of Fish & Game (ADF&G) is "to protect, maintain, and improve the fish, game, and aquatic plant resources of the State, and manage their use and development in the best interest of the economy and the well-being of the people of the State, consistent with the sustained yield principle." Pursuant to 5 AAC 95.420, activities except for lawful hunting, trapping, fishing, viewing, and photography occurring in state game refuges, state recreation areas, across designated wild and scenic rivers, or through state parks require a special area permit. In addition, the use of helicopters or motorized vehicles requires a permit.

The ADF&G manages the Minto Flats State Game Refuge, which would be intersected by the proposed GCF to MP 540 segment at various locations between proposed Project MP 418.4 and MP 455.4. The refuge encompasses approximately 500,000 acres and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana (ADF&G 2012). The refuge was established by the Alaska Legislature in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of hunting, fishing, trapping, and other compatible public uses within the Minto Flats area (ADF&G 1992).

The ADF&G also manages Palmer Hay Flats State Game Refuge, which is the location of one of the proposed Project's material sites. The refuge protects approximately 28,800 acres of coastal and freshwater wetlands, tidal sloughs and mudflats, lakes and streams, and upland birch forests near Wasilla. The refuge was established by the Alaska Legislature in 1975 to protect and preserve the natural habitat and game populations (ADF&G 2002).

The Minto Flats State Game Refuge and the Palmer Hay Flats State Game Refuge are the only ADF&G-managed units that would be transected by proposed Project facilities. Other special areas managed by ADF&G that would be within the vicinity of the proposed Project features, but would not be transected by the proposed Project facilities, are discussed in Section 5.10, Recreation.

ADNR Mental Health Trust Authority

Alaska Mental Health Trust Lands exist in the proposed Project area. The Trust manages approximately 1 million acres across the State of Alaska. Income derived from trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska. Resource categories managed by the trust land office include coal, gas, materials (sand, gravel, rock, and stone), minerals, oil, real estate, and timber (STB 2010).

Alaska Railroad Corporation

The Alaska Railroad Corporation (ARRC) is an independent corporation owned by the State of Alaska. The State of Alaska prohibits the ARRC from selling, exchanging, or otherwise conveying a complete interest in its land. However, the ARRC leases non-operating lands to sustain its transportation assets (ARRC 2011). The proposed Project would require a permit from the ARRC prior to the use of ARRC-owned lands.

Alaska Department of Transportation & Public Facilities

The Alaska Department of Transportation and Public Facilities (DOT&PF) designs, constructs, operates, and maintains the state's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors. These include more than 5,000 miles of paved and gravel highways; more than 300 aviation facilities, including 260 airports; 43 small harbors; and a ferry system covering 3,500 nautical miles and serving 33 coastal communities (Alaska DOT&PF 2011). Pursuant to 17 AAC 15.011, Alaska DOT&PF has the authority to grant a permit authorizing an applicant to construct or install utility facilities within a department ROW on lands owned by the State of Alaska. The proposed Project would utilize portions of Alaska DOT&PF ROWs. The proposed pipeline would parallel the Dalton Highway corridor from the North Slope to near Livengood. The pipeline would then be routed south and would join the Parks Highway corridor west of Fairbanks near Nenana. From there the pipeline would continue south along the Parks Highway corridor, terminating at MP 737. It then would connect at MP 39 of the Beluga Pipeline near Wasilla.

Local Regulations

AS §§ 29.35 and 29.40 define the authority of cities and boroughs to provide for planning, platting, and land use regulations. Planning powers are either mandatory or optional depending upon the classification of the city or borough.

North Slope Borough

The North Slope Borough asserts jurisdiction over activities within its boundaries on private and state-owned lands. As a home rule borough, the North Slope Borough spells out its powers and duties through its adopted charter ratified by the voters, and it can exercise powers not prohibited by state or federal law or by the home rule charter (AS 29.10). Section 8.0101 of the North Slope Borough Charter established a planning commission with the administrative responsibility for platting, land use control, and zoning for the borough. The commission makes recommendations to the mayor regarding the comprehensive plan (see Existing Land Use Plans below for a description of the North Slope Borough Comprehensive Plan), capital improvements program, fiscal policies, and public services. The legislative assembly adopts land use and zoning regulations by ordinance.

Pursuant to the North Slope Borough Land Management Regulations (NSBMC §§ 19.10.010 — 19.70.060), the North Slope Borough requires compliance with its zoning and permitting ordinances and issues permits for development, uses, and activities on land within the Borough. For development within a North Slope Borough village, a Village District Permit must be obtained. The proposed Project would not intersect any Village District.

Prudhoe Bay

Prudhoe Bay, a census-designated place (CDP), would be intersected by the GCF to MP 540 segment. The GCF would also be located within this CDP. There are no land use restrictions for Prudhoe Bay that apply to pipeline development other than those afforded by the North Slope Borough.

Yukon-Koyukuk Census Area

The GCF to MP 540 segment and the Fairbanks Lateral would both intersect the Yukon-Koyukuk Census Area (YKCA). As described in Section 5.12, Socioeconomics, and shown in Figure 5.12-1, the YKCA is a 148,000 square mile portion of Alaska's Unorganized Borough, which encompasses nearly 323,400 square miles of the State. The Unorganized Borough comprises the lands of Alaska not within the boundaries of the state's organized boroughs. Planning and zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Nenana

The City of Nenana does not have rigorous land use or zoning designations. Development within the City requires mayoral approval of a Land Use Permit (J. Mayrand Pers. Comm. 2010).

CDPs

The GCF to MP 540 segment would intersect the boundaries of the following CDPs within the Yukon-Koyukuk Census Area: Coldfoot, Four Mile Road, Livengood, and Wiseman. As for the Unorganized Borough, planning and zoning within these CDPs is overseen by the state legislature.

Fairbanks North Star Borough

The Fairbanks North Star Borough (FNSB), as a second class borough, is required to provide for planning, platting, and land use regulations on an area-wide basis (both inside and outside of cities) within the borough in accordance with AS § 29.40. The borough's planning commission was established by Chapter 2.40 of the borough's Code of Ordinances. The commission is charged with preparing and recommending to the legislative assembly appropriate policies, plans, and ordinances for the implementation of the municipal planning, official map, comprehensive plan and zoning functions; acting as an appeals body of decisions of the Platting Board; and acting upon requests for exceptions to the Zoning Code (Title 18). The borough requires that an approved zoning permit be acquired prior to excavation, construction, relocation, or installation for a new land use. Pursuant to the Zoning Code, the installation and maintenance of utility lines are permitted uses in the zoning districts.

CDPs

The GCF to MP 540 segment would intersect the boundaries of the College and Ester CDPs, which are subject to the area-wide FNSB planning, platting, and land use regulations. The proposed Project segment would not be located within the City of Fairbanks municipal boundaries; therefore, there would not be any land use restrictions associated with the City of Fairbanks.

Denali Borough

As a home rule borough, the Denali Borough (DB) spells out its powers and duties through its adopted charter ratified by the voters, and it can exercise powers not prohibited by state or federal law or by the home rule charter (AS 29.10). Section 7.01 of the DB Charter established a planning commission to perform the functions of platting, planning, and zoning for the borough. Pursuant to Section 5.25 of the DB Charter, the commission holds public hearings and makes recommendations to the legislative assembly regarding planning, zoning, amendments to ordinances, and the enforcement of appropriate regulations.

Anderson, Healy, McKinley Park, and Cantwell

The City of Anderson and the communities of Healy, McKinley Park, and Cantwell, would be intersected by the proposed pipeline. The City of Anderson is the only incorporated place within DB. There are no land use restrictions for these communities that apply to pipeline development other than those afforded by the DB. See the subsection Existing Land Use Plans below for a discussion of development within parcels owned by the City of Anderson.

Matanuska-Susitna Borough

The Matanuska-Susitna (Mat-Su) Borough, as a second class borough, is required to provide for planning, platting, and land use regulations on an area-wide basis (both inside and outside of cities) within the borough in accordance with AS § 29.40. The Mat-Su Borough may delegate these powers to a city within the borough (AS § 29.40.010).

The Mat-Su Borough's Planning Commission was established to perform the area-wide functions of planning, platting, and zoning. The Commission's recommendations are then transmitted to the Mat-Su Borough Assembly, a body of elected district representatives that sets policy and exercises legislative power within the borough. According to MSB Chapter 15.24 Assembly, Zoning Functions, the Assembly has the authority, with the Planning Commission's recommendation, to establish building and land use regulations and create districts (MSB 15.24.015). With the assistance of the Planning Commission, the Assembly prepares and revises the Mat-Su Borough Wide Comprehensive Plan (Mat-Su Borough 2005a). The Mat-Su Borough Wide Comprehensive Plan provides general goals and policy recommendations for a 20-year period to address development patterns, technological advances, a growing population, and a diversifying economy.

The Mat-Su Borough uses both Borough-wide and special use district (SpUD) ordinances. Mat-Su Borough-wide ordinances employ setback standards, including a 75-foot water-body setback adopted by voter initiative; sanitary solid waste disposal sites; and mobile home park standards. SpUDs are tailored to a local community's special conditions and are unique to the geographic boundary of each community. Local communities have the ability to redefine a particular borough-wide measure through their SpUD ordinances (STB 2010). Land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit.

The MP 555 to End segment would pass through the communities of Trapper Creek, Susitna, Willow, Big Lake, and Point MacKenzie. Each of their community councils currently has or is developing a comprehensive plan. These community comprehensive plans are consistent with the general goals and recommendations of the Mat-Su Borough Wide Comprehensive Plan.

5.9.1.2 Existing Land Use

Land Ownership

<u>Federal</u>

The federal government owns parcels within the proposed ROW that are managed by the BLM, USDOD (Clear AFS), and NPS. The Denali National Park alternative crosses additional federal lands managed by the NPS. The State of Alaska, University of Alaska, AHTNA, Inc., and the Toghotthele Corporation have selected federally owned lands within the proposed Project ROW.

<u>State</u>

The State of Alaska owns the greatest number of parcels within the proposed ROW. Lands owned by the State of Alaska are managed by the ADNR under the guidance of regional land use plans (see Existing Land Use Plans). The proposed Project would utilize portions of state lands. Pursuant to 17 AAC 15.011, Alaska DOT&PF has the authority to grant a permit authorizing an applicant to construct or install utility facilities within a department ROW on lands owned by the State of Alaska. Portions of the proposed Project would cross trails established under Revised Statute 2477 (R.S. 2477), as discussed further below. As R.S. 2477 trail ROWs are easements and are not owned by the State, land ownership at these crossings are addressed under the respective land ownership sections.

ADNR Mental Health Trust Authority

Alaska Mental Health Trust Lands would be intersected by the proposed ROW. The Trust manages approximately 1 million acres across the State of Alaska. Income derived from trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska. Resource categories managed by the trust land office include coal, gas, materials, minerals, oil, real estate, and timber (STB 2010).

University of Alaska

The University of Alaska currently owns and manages approximately 150,000 acres in Alaska. Some of this land would be intersected by the proposed ROW. University “trust lands” are managed for the use and benefit of the University and are not considered state public domain land. The University develops, leases, and sells land and resources to generate funds for the University of Alaska’s Land Grant Trust Fund (STB 2009).

Alaska Railroad Corporation

The ARRC is an independent corporation owned by the State of Alaska. The State of Alaska prohibits the ARRC from selling, exchanging, or otherwise conveying a complete interest in its land. However, the ARRC leases non-operating lands to sustain its transportation assets (ARRC 2011).

Local

The cities of Anderson and Nenana own parcels within the proposed ROW. Other local governmental entities having ownership of parcels within the proposed ROW include the FNSB, Mat-Su Borough, Nenana Airfield, and the Railbelt School District.

Alaska Native Regional and Village Corporations

In 1971, President Richard Nixon signed into law the Alaska Native Claims Settlement Act (ANCSA). Under ANCSA, aboriginal financial and land claims were settled in exchange for $962.5 million in compensation, as well as approximately 40 million acres (Norris 2002). The ANCSA established twelve for-profit Alaska Native regional corporations (a thirteenth corporation was later added for Alaska Natives living outside the State), which administers claims from the settlement. In addition, more than 200 Alaska Native village corporations were created. Both the regional and village corporations own land in and around native villages, with ownership proportionate to the enrolled populations of these corporations during the 1970s. Surface rights to the land are owned by the village corporations, with subsurface rights controlled by regional corporations. In turn, the village and regional corporations are owned by enrolled Alaska Natives (Linxwiler 2007). Approximately 80,000 Natives are enrolled under ANCSA, and receive 100 shares for the village corporation in which they are enrolled and the same amount for the regional corporation in which they are enrolled (Chance 1999).

Native corporation land is often held in large tracts and used for subsistence purposes or developed/sold to generate revenue for the corporation. Native regional corporation-owned lands within the proposed Project area would consist of parcels with subsurface rights owned by Doyon, Ltd. and Ahtna, Inc. The Toghotthele Corporation, a Native village corporation representing the Native village of Nenana, owns surface rights to parcels within the proposed Project area.

As private land, uses on land owned by native corporations, are subject to approvals of the surface and subsurface landowners. Doyon, Ltd. manages its lands for responsible economic development of natural resources, protection of cultural and historic sites, and commercial and non-commercial use by shareholders. Non-commercial use permits may be obtained by shareholders (Doyon Ltd 2011). Ahtna, Inc. also requires a permit for use of its lands, including a permit fee for public and commercial activities. Ahtna, Inc. lands are managed for mineral exploration, timber resources, tourism, some types of hunting, and predator control, among other uses (Ahtna, Inc. 2011).

Native Allotments

Under the Alaska Native Allotment Act of 1906 (34 § 197), qualifying Alaska Natives were allotted up to 160 acres of non-mineral land. The proposed Project ROW would intersect Alaska Native Allotments awarded under the Act. The Tanana Chiefs Conference manages a trust service with the Bureau of Indian Affairs and acts as trustee for native allotment property owners on behalf of the 42 villages of Interior Alaska.

Private Landowners

Private lands in the proposed Project area are used for residential, agricultural, and commercial purposes. As private land, land uses are subject to approvals of the landowner.

Proposed Action

The majority (605 miles; 78.5 percent) of land traversed by the proposed Project ROW is under State ownership. Land ownership along the proposed Project ROW is displayed in Table 5.9-1(a). Federal land accounts for 13 percent (100.2 miles) of the land that would be crossed by the pipeline ROW. Native corporation (16.1 miles; 2.1 percent), private (15.4 miles; 2.0 percent), municipal/borough (29.6 miles; 3.8 percent), and Native allotment lands (2.2 mile; 0.3 percent) would also be intersected.

TABLE 5.9-1 (a) Current Ownership Crossed by the Proposed Project ROW in Distance (Miles)

Segment	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation	Misc/ Stream Crossings
Proposed Action							
GCF to MP 540	100.2	413.2	3.4	15.3	1.6	5.0	0.7
Fairbanks Lateral	0	20.3	8.1	6.1	0	0	0
MP 540 to MP 555	0	8.0	0.3	0	0	7.2	0
MP 555 to End	0	163.5	3.6	8.2	0.6	3.9	1.6
Proposed Action Total	**100.2**	**605.0**	**15.4**	**29.6**	**2.2**	**16.1**	**2.3**
Denali National Park Route Variation*	**7.9**	**5.6**	0	0	1.9	0	0

Source: AGDC 2012c. Request for Information 162: Transmittal of the most current land ownership. GeoData (LandOwnership_ROW_v5.mdb).
* Denali National Park Route Variation source: ADNR 2011b. Alaska State Geo-spatial Data Clearinghouse: Alaska General Land Status.

Most of the proposed Project ROW along the GCF to MP 540 segment would be on federal and state land. Of the 539.4 miles of land that would be crossed by the pipeline within the segment, federal land would account for 100.2 miles (18.6 percent), state land would account for 413.2 miles (76.6 percent), and private land would account for 3.4 miles (0.6 percent). The GCF to MP 540 segment would also cross through 5.0 miles (0.9 percent) of Native corporation land and 15.3 miles (2.8 percent) of municipal/borough land.

The majority of the land that would be crossed by the Fairbanks Lateral is under state ownership (20.3 miles; 59.0 percent). The segment also would cross land under private ownership (8.1 miles; 23.5 percent) as well as 6.1 miles (17.7 percent) of municipal / borough owned lands.

The MP 540 to MP 555 segment would cross land under state (8.0 miles; 51.3 percent), Native corporation (7.2 miles; 46.2 percent), and private (0.3 mile; 1.9 percent) ownership.

The majority of the MP 555 to End segment would be under state ownership (163.5 miles; 90.1 percent). Private (3.6 miles; 2.0 percent), municipal/borough (8.2 miles; 4.5 percent), and

Native corporation (3.9 miles; 2.1 percent), and Native allotment (0.62 miles; 0.3 percent) lands would also be intersected.

As shown in Table 5.9-1(b), the majority of land that would be occupied by the aboveground facilities is currently under state ownership (73.5 acres), with the largest footprint attributable to the GCF (68.7 acres). Other types of land ownership include municipal/borough (5.2 acres) and federal ownership (2.9 acres).

TABLE 5.9-1(b) Current Ownership Occupied by the Operational Footprint of the Aboveground Facilities (Acres)

Aboveground Facility	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation
Compressor Station (MP 225)	1.4	0.0	0.0	0.0	0.0	0.0
Compressor Station (MP 286.6)	1.4	0.0	0.0	0.0	0.0	0.0
Compressor Station (MP 458.1)	0.0	1.4	0.0	0.0	0.0	0.0
GCF (GCF to MP 540)	0.0	68.7	0.0	0.0	0.0	0.0
NGL Extraction Facility (MP 555 to End)	0.0	0.0	0.0	5.2	0.0	0.0
Fairbanks Lateral Take-Off Facility (Fairbanks Lateral)	0.0	3.3	0.0	0.0	0.0	0.0
Total	**2.9**	**73.5**	**0.0**	**5.2**	**0.0**	**0.0**
Source: National Landcover Dataset USGS 2001						

Section 2.2.7 provides estimates of the volume of solid waste that would be generated during the construction and operation phases of the Project. As described therein, AGDC would use either landfills or incinerators for disposal of solid waste. Existing permitted landfills would be used, and the operators would decide whether or not to accept this solid waste. Therefore, because no new disposal sites would be developed for the proposed Project, no additional land use impacts would occur as a result of solid waste generation. Incineration would be used only where the appropriate permits can be obtained, and any air emissions from permitted incinerators would have been accounted for in the permit actions at the approved facilities. At this time, AGDC does not have enough information to be able to identify what will be landfilled and what will be incinerated, or to identify which specific facilities would be used. AGDC would haul solid waste as far as necessary to reach suitable disposal facilities.

AGDC has indicated that construction camps for the proposed Project would be located on existing permitted construction sites. However, the BLM has stated that some of these sites are no longer authorized and have been abandoned and rehabilitated to some extent; therefore, there would be some impacts to reopening these sites, or in some cases expanding areas of use (BLM 2012). Detailed data about the boundaries and level of reclamation of these construction sites are not available. The maximum amount of disturbance that would occur at each site would be the total footprint of the construction camp, which is estimated at between 8.5 and 10 acres for each mobile camp as well as for each of the 15 stationary construction camps.

Construction

Construction of the proposed Project pipeline ROW would affect a total of 10,902 acres (not including access roads—see instead Section 5.9.1.4). Land ownership that would be affected by the construction ROW is displayed in Table 5.9-2. State land would comprise 72.4 percent of the total, federal land 16.9 percent, and municipal/borough land 4.5 percent. Private (2.0 percent), Native allotment (0.4 percent), and Native corporation land (3.4 percent) would also be intersected, along with water (0.4 percent). Of the land affected, 7,544 acres or 69.2 percent would be in the GCF to MP 540 segment, 417.2 acres (3.8 percent) would be in the Fairbanks Lateral, 478.3 acres (4.4 percent) would be in the MP 540 to MP 555 segment, and 2,462.6 or 22.6 percent would be in the MP 555 to End segment.

TABLE 5.9-2 Current Land Ownership Affected by the Construction ROW and Temporary Extra Workspaces (Acres)

Segment	Federal	State	Private	Municipal/ Borough	Native Allotments	Native Corporation	Misc/Stream Crossings
Construction ROW							
GCF to MP 540	1515.1	4957.9	49.1	234.2	24.7	57.6	20.5
Fairbanks Lateral	0	232.5	86.0	98.7	0	0.0	0
MP 540 to MP 555	0	233.3	7.6	0	0	208.1	0
MP 555 to End	3.7	1951.3	44.2	112.2	8.9	58.2	20.4
Temporary Extra Workspaces							
TEW GCF to MP 540	323.8	311.7	10.1	21.1	5.9	12.0	0.8
TEW MP 540 to MP 555	0	19.5	0	0	0	9.9	0
TEW MP 555 to END	2.2	187.9	16.9	28.4	3.6	21.7	3.1
Proposed Action Total	**1844.7**	**7894.0**	**213.9**	**494.6**	**43.1**	**367.0**	**44.6**
Denali National Park Route Variation*	**95.3**	**67.8**	**0**	**0**	**22.4**	**0**	**0**

Source: Landownership provided by AGDC, June 2012
* Denali National Park Route Variation source Alaska General Land Status (Alaska State Geo-spatial Data Clearinghouse ADNR 2011b)
Note: Totals may not sum due to rounding.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: construct a new aerial suspension bridge (the Applicant's Preferred Option); utilize the existing E.L. Patton Bridge (Option 2); or utilize the Horizontal Directional Drilling (HDD) method (Option 3). Most of the land that would be crossed under Option 2 is under state ownership (2.0 miles, 83.3 percent), with an additional 0.4 mile (0.2 percent) under federal management. The land that would be crossed under Options 1 and 3 is also primarily under state ownership (1.3 miles, 80 percent), with an additional 0.6 mile (20 percent) under federal management.

Construction of a new aerial bridge (the Applicant's Preferred Option) would require a construction area of approximately one acre of land within the ROW on each side of the Yukon River. Option 2 would result in the least impacts to land use since it would utilize the existing bridge and not require any additional construction areas. Option 3 would result in construction of one acre of land within the ROW on each side of the Yukon River in order to place the pipe underneath the river. Overall, more land would be impacted from building a suspension bridge (the Applicant's Preferred Option) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2). Both the Applicant's Preferred Option and Option 3 would intersect one or more Native allotments.

Denali National Park Route Variation

The Denali National Park Route Variation would cross mainly federal (7.9 miles; 51.3 percent) and Native allotment (1.9 miles; 12.3 percent) lands. State lands (5.6 mile; 36.4 percent) would also be crossed by the Denali National Park Route Variation.

Construction

Construction under the Denali National Park Route Variation would affect a total of approximately 292.8 fewer acres than under the MP 540 to MP 555 segment. While federal ownership would not be affected by the MP 540 to MP 555 segment, 95.3 acres under federal ownership would be affected by the Denali National Park Route Variation. Fewer acres of state, private, and Native corporation lands and more acres of Native allotment lands would be affected by the Denali National Park Route Variation than the MP 540 to MP 555 segment, as shown in Table 5.9-2.

5.9.1.3 Land Cover

Proposed Action

Land cover in the proposed Project area was determined through the use of the National Land Cover Dataset (USGS 2001). Based on this data, the proposed Project would cross developed, agricultural, scrub-shrub, forest, water and wetlands, and barren land covers. Note that due to the use of desktop land cover data sources, numbers reported in this section may not match values reported for field derived data (such as wetland data).

As shown in Table 5.9-3, of the approximately 770.8 miles that would be crossed by the proposed Project ROW, much of the land cover would consist of forest (316.7 miles, or 41.1 percent), shrub/scrub (226.2 miles; 29.3 percent), and developed areas (131.0 miles; 17.0 percent). Lesser quantities of water/wetlands (73.2 miles; 9.5 percent), barren land (22.7 miles; 2.9 percent), and agricultural lands (1.0 mile; 0.1 percent) would also be crossed by the proposed Project ROW. As described above, these land covers are derived from the National Land Cover Dataset; therefore, the water/wetlands land cover category differs from the 'water' ownership classification described above.

TABLE 5.9-3 Land Cover Types Crossed by the Proposed Pipeline ROW (Miles)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	98.8	0.2	201.6	183.9	33.2	21.7
Fairbanks Lateral	1.1	0.0	0.6	12.8	19.9	0.0
MP 540 to MP 555	0.0	0.0	3.8	10.7	1.0	0.1
MP 555 to End	31.1	0.8	20.2	109.3	19.1	0.9
Proposed Action Total	**131.0**	**1.0**	**226.2**	**316.7**	**73.2**	**22.7**
Denali National Park Route Variation	**7.4**	**0.0**	**1.1**	**5.4**	**0.2**	**1.0**

Source: National Landcover Dataset (USGS 2001)

Within the GCF to MP 540 segment, the most common land covers would include shrub/scrub (201.6 miles), forest (183.9 miles), and developed land (98.8 miles). The remaining land covers would be water/wetland (33.2 miles), barren land (21.7 miles), and agriculture (0.2 mile).

The Fairbanks Lateral would predominantly cross water/wetland (19.9 miles) and forest (12.8 miles). Other land covers would include developed land (1.1 miles) and shrub/scrub (0.6 mile).

Land covers along the MP 540 to MP 555 segment would include forest (10.7 miles), shrub/scrub (3.8 miles), water/wetland (1.0 mile), and barren land (0.1 mile).

Along the MP 555 to End segment, land covers would include forest (109.3 miles), developed land (31.1 miles), shrub/scrub (20.2 miles), water/wetland (19.1 miles), barren land (0.9 mile), and agriculture (0.8 mile).

Construction

The types of land cover along the construction ROW including Temporary Extra Workspaces (TEWs) would vary. As shown in Table 5.9-4, the predominant land covers along the proposed Project construction ROW would be forest (4,500.6 acres; 41.2 percent), shrub/scrub (3,214.1 acres; 29.4 percent), and developed land (1,792.7 acres; 16.4 percent). Other land covers would include water/wetland (1031.2 acres; 9.4 percent), barren land (356.7 acres; 3.2 percent), and agriculture (11.4 acres; 0.1 percent). The estimates in Table 5.9-4 include temporary work space areas.

Yukon River Crossing Options

More land would be impacted from building a suspension bridge (the Applicant's Preferred Option) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2). During construction, the Applicant's Preferred Option and Option 3 would affect approximately 28.7 more acres of forestland, 13.8 more acres of water/wetland, 10.2 fewer acres of developed land, and 0.9 fewer acres shrub/scrub land covers than Option 2.

TABLE 5.9-4 Land Cover Affected by Proposed Construction ROW (Acres)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	1,316.7	2.1	2,539.2	2,276.4	418.0	307.3
TEWS (GCF to MP 540)	37.0	0.0	282.2	279.9	53.8	36.0
Fairbanks Lateral	13.0	0.0	7.7	153.2	242.6	0.7
TEWS (MP 540 to MP 555)	0.0	0.0	6.4	22.2	0.8	0.0
MP 555 to END	404.0	9.3	245.9	1,293.1	236.3	10.3
TEWS (MP 555 to END)	22.0	0.0	22.8	170.2	47.6	1.2
Proposed Action Total	**1,792.7**	**11.4**	**3,214.0**	**4,500.6**	**1031.2**	**356.7**
Denali National Park Route Variation	**85.6**	**0.0**	**13.3**	**70.7**	**3.7**	**12.2**

Source: National Landcover Dataset USGS 2001 Acreage calculations are based on 100-foot-wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012)

Operation

The permanent ROW of the proposed Project would also affect land cover. As shown in Table 5.9-5(a), forest and shrub/scrub would be the most common land cover affected by the proposed Project permanent ROW, accounting for 1,339.5 acres (38.9 percent) and 1,065.9 acres (31.0 percent), respectively. The remaining affected land cover would include developed land (623.2 acres; 18.1 percent), water/wetland (274.5 acres; 8.0 percent), barren land (133 acres; 3.9 percent), and agriculture (3.7 acres; 0.1 percent).

TABLE 5.9-5(a) Current Land Cover Affected by the Permanent ROW (Acres)

Segment	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Proposed Action						
GCF to MP 540	505.1	0.6[a]	975	856.6	128.8	129.1
Fairbanks Lateral	3.9	0.0	2.2	46.4	72.5	0.1
MP 540 to MP 555	0.0	0.0	13.9	39	3.6	0.2
MP 555 to End	114.2	3.1[b]	74.8	397.5	69.6	3.4
Proposed Action Total	**623.2**	**3.7**	**1,065.9**	**1,339.5**	**274.5**	**132.8**
Denali National Park Route Variation	**29.2**	**0.0**	**4.1**	**22.1**	**1.1**	**4.1**

[a] Consists entirely of cultivated crop land covers.
[b] Agricultural land covers along this segment include cultivated crops (2.8 acres) and pasture/hay land covers (0.4 acres).
Source: National Landcover Dataset USGS 2001 within Permanent ROW (53 ft Federal Lands ROW and 30 ft State/Private Lands ROW).

The operational footprint of the aboveground facilities (Table 5.9-5[b]) would have the greatest effect on shrub/scrub, with 69.2 acres affected (primarily by the GCF). Other land covers within the operational footprint of the aboveground facilities would include forest (10.7 acres), water/wetland (1.2 acres), and developed lands (0.32 acre).

TABLE 5.9-5(b) Current Land Cover Affected by the Operational Footprint of the Aboveground Facilities (Acres)

Aboveground Facility	Developed	Agriculture	Shrub/ Scrub	Forest	Water/ Wetland	Barren Land
Compressor Station (MP 225)	0.0	0.0	1.4	0.0	0.0	0.0
Compressor Station (MP 286.6)	0.0	0.0	0.2	1.3	0.0	0.0
Compressor Station (MP 458.1)	0.0	0.0	0.0	1.4	0.0	0.0
GCF (GCF to MP 540)	0.0	0.0	67.6	0.0	1.1	0.0
NGL Extraction Facility (MP 555 to END)	0.32	0.0	0.0	4.7	0.1	0.0
Fairbanks Lateral Take-Off Facility (Fairbanks Lateral)	0.0	0.0	0.0	3.3	0.0	0.0
Total	**0.32**	**0.0**	**69.2**	**10.7**	**1.2**	**0.0**

Source: National Landcover Dataset USGS 2001

Yukon River Crossing Options

More land would be impacted from building a suspension bridge (the Applicant's Preferred Option) and using the HDD method (Option 3) than utilizing the existing E.L. Patton Yukon River Bridge (Option 2). For the permanent ROW, the Applicant's Preferred Option and Option 3 would affect approximately 1.2 more acres of forestland, 0.6 more acres of water/wetland, 4.6 fewer acres of developed land and 0.3 fewer acres shrub/scrub land covers than Option 2.

Denali National Park Route Variation

Compared to the MP 540 to MP 555 segment, the Denali National Park Route Variation segment would cross more barren land (1.0 mile) and less forest (5.4 miles), shrub/scrub (1.1 miles), and water/wetland (0.2 mile). Whereas the MP 540 to MP 555 segment would not cross developed land, the Denali National Park Route Variation would cross 7.4 miles of developed land (see Table 5.9-3).

Construction

As shown in Table 5.9-4, construction of the Denali National Park Route Variation would affect more acres of developed land than the MP 540 to MP 555 segment (85.6 acres compared to 0.1 acre), more acres of barren land (12.2 acres compared to 1.3 acre) and fewer acres of shrub/scrub, forest, and water/wetland.

Operation

Under the Denali National Park Route Variation, approximately 29 acres of developed land would be affected by proposed Project operations; in contrast, the MP 540 to MP 555 segment would not affected developed land. Operation of the Denali National Park Route Variation would affect more acres of barren land but fewer acres of shrub/scrub, forest, and water/wetlands than the MP 540 to MP 555 segment (see Table 5.9-5[a]).

5.9.1.4 Temporary and Permanent Access Roads

The proposed Project would rely, to the extent practicable, on existing marine transport, rail transport, and public roads to transport equipment, materials, and personnel. Where necessary, access roads would be constructed to provide access to the proposed pipeline ROW, compressor stations, block valves, camps, laydown yards, material sites, and water sources.

Proposed Action

Construction

Construction of the proposed Project would require the use of 647.7 acres for access roads (see Table 5.9-6[a]); including 527.2 acres in the GCF to MP 540 segment, 75.6 acres in the Fairbanks Lateral, 9.2 acres in the MP 540 to MP 555 segment, and 35.7 acres in the MP 555 to End segment. The construction ROW of the access roads would predominantly affect forest (435.7 acres), shrub/scrub (123.2 acres), and developed lands (45.1 acres). Water/wetland (39.1 acres) and agricultural lands (2.3 acre) would also be affected (see Table 5.9-6[b]).

TABLE 5.9-6(a) Land Affected by Access Roads (Acres)

Segment	Construction ROW[a,b]	Operational ROW[a,c]
Proposed Action		
GCF to MP 540	527.2	521.4
MP 540 to MP 555	9.2	9.2
MP 555 to END	35.7	21.8
Fairbanks Lateral	75.6	75.6
Proposed Action Total	**647.7**	**628.0**
Denali National Park Route Variation	**-**	**-**

[a] Access Roads acreage is for roadway coverage provided by AGDC and not complete 50-foott right-of-way.

[b] Construction acreage is for both permanent and temporary access roads.

[c] Operational acreage is only for permanent access roads

Notes: Total Number Access Roads Mainline = 127; Total Number Access Roads Fairbanks = 5

Source: AGDC 2012b. Request for Information 156: Transmittal of delineated wetlands within access road polygons (AES_RTS_Access_Roads.gdb). Acreage estimates include roadway coverage provided by AGDC and not complete 50-foot ROW

TABLE 5.9-6(b) Current Land Cover Affected by Access Roads[a] (Acres)

	Fairbanks Access Roads		Mainline Access Roads		Block Valves	
Land Cover	**Construction[b] ROW**	**Operational[c] ROW**	**Construction[b] ROW**	**Operational[c] ROW**	**Construction[b] ROW**	**Operational[c] ROW**
Developed	14.2	14.2	30.9	27.7	0.1	0.5
Agriculture	0.0	0.0	2.3	2.3	0.0	0.0
Shrub/Scrub	2.5	2.5	120.7	115.7	0.3	0.8
Forest	53.1	53.1	382.6	371.6	0.4	0.9
Water/Wetland	5.5	5.5	33.6	33.1	0.0	0.1
Barren Land	0.1	0.1	1.9	1.8	0.0	0.1
Total	**75.4**	**75.4**	**572.0**	**552.2**	**0.8**	**2.4**

[a] Access Roads acreage for roadway coverage provided by AGDC and not complete 50-foot ROW (AES 2012)

[b] Construction acreage is for both permanent and temporary access roads.

[c] Operational acreage is only for permanent access roads.

Notes: Total Number Access Roads Mainline = 127; Total Number Access Roads Fairbanks = 5

Sources: AGDC Access Roads; USGS 2001 National Landcover Dataset

Yukon River Crossing Options

No new access roads would be required for any of the three options selected to cross the Yukon River.

Operation

Proposed Project operations would require approximately 628.0 acres for permanent access roads, including 521.4 acres in the GCF to MP 540 segment, 75.6 acres in the Fairbanks Lateral, 9.2 acres in the MP 540 to MP 555 segment, and 21.8 acres in the MP 555 to End segment (see Table 5.9-6[a]). The operational ROW of the access roads would predominantly affect forest (424.7 acres), shrub/scrub (118.2 acres), and developed land (41.9 acres). Water/wetland (38.6 acres) and agricultural land (2.3 acres) would also be affected (see Table 5.9-6[b]).

Yukon River Crossing Options

No new access roads would be required under any of the options for crossing the Yukon River.

Denali National Park Route Variation

As described in Section 4.4.2.3, the Denali National Park Route Variation would be co-located with the Parks Highway; therefore, there would be no need for access roads under the Denali National Park Route Variation.

5.9.1.5 R.S. 2477 ROW, 17(b) Easements, and Section-Line Easements Intersected by the Proposed Project

Proposed Action

R.S. 2477 ROW

The proposed Project would intersect trails established under R.S. 2477. R.S. 2477, located in Section 8 of the Mining Law of 1866, states: "The right of way for the construction of highways over public lands, not reserved for public uses, is hereby granted." Although the law was repealed by Congress with the enactment of FLPMA in 1976, the pre-existing rights attributable to R.S. 2477 trails established under the statute remain in effect. Where an R.S. 2477 ROW exists, a new landowner's title is subject to the ROW, which must still be honored (ADNR 2001a).

Twenty R.S. 2477 trails would be crossed by proposed Project construction and operation, as shown in Table 5.9-7(a). The GCF to MP 540 segment would intersect 14 of these ROWs, and the Fairbanks Lateral and MP 555 to End segment would cross 2 and 4 of these ROWs, respectively. No R.S. 2477 ROW would be intersected by the MP 540 to MP 555 segment.

17(b) Easements

The proposed Project would intersect easements designated under Section 17(b) of ANSCA, which allows reserving easements on lands that will be conveyed to Alaska Native Village and Regional Corporations to allow public access to public land and water. 43 CFR 2650.4-7 describes the guidelines that are used in reserving easements in conveyance documents. 17(b) easements are reserved and managed by the federal government.

Ten 17(b) easements would be crossed by proposed Project construction and operation, as shown in Table 5.9-7(b). The GCF to MP 540 segment would intersect one of these easements, and the MP 540 to MP 555 and the MP 555 to End segment would cross two and seven of these easements, respectively. No 17(b) easements would be intersected by the Fairbanks Lateral.

Section Line Easements

The proposed Project would intersect section-line easements, which are public ROW 33, 50, 66, 83 or 100 feet wide that are located along a section line of the rectangular survey system. Some section-line easements are also R.S. 2477 ROW.

TABLE 5.9-7(a) R.S. 2477 ROW Intersected by the Proposed Project

Segment	R.S. 2477 Trail ROW	File Number	Approximate Mileposts
Proposed Action			
GCF to MP 540	Hickel Highway	RST 450	65.1, 306.4
	Wiseman-Chandalar	RST 254	223.5
	Coldfoot-Chandalar Lake Trail	RST 9	246.2
	Caro-Coldfoot	RST 262	246.2
	Coldfoot-Junction Trail 49	RST 591	246.2
	Slate Creek	RST 412 / RST 412	246.2, 260.4
	Hunter Creek-Livengood	RST 468	405.1
	Dunbar-Brooks Terminal	RST 66	406.2, 452.5, 454
	Dunbar-Minto Tolovana	RST 1595	457.9
	Nenana-Kantishna	RST 346	476.1
	Kobi-McGrath	RST 345	499.8
	Rex-Roosevelt	RST 491	500.7
	Kobi-Kantishna	RST 343	500.7
	Healy-Diamond Coal Mine Dirt Road	RST 709	530.3
Fairbanks Lateral	Easter-Dunbar	RST 70	
	Ester Dome - Nugget Creek Trail	RST 1602	
MP 540 to MP 555	None		
MP 555 to End	Cantwell Small Tracts Road (Lovers Lane)	RST 625	567.8
	Goose Creek Road	RST 1506	686.3
	Nancy Lake-Susitna	RST 149	719.6
	Knik-Susitna	RST 118	732.2
Denali National Park Route Variation	None		

TABLE 5.9-7(b) 17(b) Easements Intersected by the Proposed Project

Segment	17(b) Easement Number	Approximate Mileposts
Proposed Action		
GCF to MP 540	7 D9, L	484.6
Fairbanks Lateral	None	n/a
MP 540 to MP 555	21, L	549.4
	17a, L	553.3
MP 555 to End	16 C5, L	558.1
	25 C4	558.1
	25 C5	558.2
	15 C5, L	561.4
	5h D1, L	572.5
	6b C5, L	582.2
	100 C4	584.5
Denali National Park Route Variation	17a, L	549.5

Source: BLM Easements Systems accessed October 2011

Yukon River Crossing Options

No R.S. 2477 trails or 17(b) easements would be intersected by crossing the Yukon River.

Denali National Park Route Variation

The Denali National Park Route Variation would not cross any R.S. 2477 ROWs or 17(b) easements.

5.9.1.6 Forest Land

Proposed Action

Construction

As shown above in Table 5.9-4, construction including TEWS of the proposed Project ROW would affect approximately 4,500.6 acres of forest land. As shown in Table 5-9.8, the proposed Project would have the greatest effect on evergreen forest, of which 2,487.0 acres would be affected. In addition, approximately 1,166.4 acres of deciduous forest and 847.0 acres of mixed forest would be affected by construction and TEWS of the proposed Project ROW.

TABLE 5.9-8 Forest Types which would be Affected by the Construction ROW (Acres)

Segment	Deciduous Forest	Evergreen Forest	Mixed Forest
Proposed Action			
GCF to MP 540	458.3	1,621.6	196.5
TEWS (GCF to MP 540)	45.1	209.3	25.5
Fairbanks Lateral	34.5	110.9	7.8
MP 540 to MP 555	6.8	278.6	20.1
TEWS (MP 540 to MP 555)	0.2	20.2	1.8
MP 555 to End	543.5	213.0	536.5
TEWS (MP 555 to End)	77.9	33.5	58.7
Proposed Action Total	**1,166.4**	**2,487.0**	**847.0**
Denali National Park Route Variation	**0.0**	**67.5**	**3.2**

Source: USGS 2001 National Landcover Dataset. Acreage calculations are based on 100-foot-wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012).

Yukon River Crossing Options

If the AGDC selects Option 2, utilize the existing E.L. Patton Bridge, the construction ROW would affect approximately 2.1, 23.6, and 3.0 fewer acres of deciduous, evergreen, and mixed forest, respectively.

Operation

As shown in Table 5.9-5(a) above, the proposed Project permanent ROW would affect approximately 1,339.5 acres of forestland. As shown in Table 5-9.9, the permanent ROW would have the greatest effect on evergreen forest, of which 780.0 acres would be affected. In addition, approximately 328.7 acres of deciduous forest and 230.7 acres of mixed forest would be affected by construction of the proposed Project.

TABLE 5.9-9 Forest Types that would be Affected by the Permanent ROW (Acres)

Segment	Deciduous Forest	Evergreen Forest	Mixed Forest
Proposed Action			
GCF to MP 540	147.5	646.7	62.3
Fairbanks Lateral	10.5	33.4	2.4
MP 540 to MP 555	1.0	35.6	2.4
MP 555 to End	169.7	64.3	163.6
Proposed Action Total	**328.7**	**780.0**	**230.7**
Denali National Park Route Variation	**0.0**	**21.1**	**1.0**

Source: USGS 2001 National Landcover Dataset within Permanent ROW (53 ft Federal Lands ROW and 30 ft State/Private Lands ROW)

Yukon River Crossing Options

For the Applicant's Preferred Option and Option 3, the permanent ROW would affect would affect approximately 0.1, 0.8, and 0.3 more acres of deciduous, evergreen, and mixed forest, respectively, than under Option 2.

Denali National Park Route Variation

Construction

As shown in Table 5.9-8, approximately 70.7 acres of forest land would be affected by construction of the Denali National Park Route Variation, compared to approximately 305.5 acres under the MP 540 to MP 555 segment. Forest types that would be encumbered include evergreen forest (67.5 acres) and mixed forest (3.2 acres).

Operation

As shown in Table 5.9-5a, operation of the Denali National Park Route Variation would permanently remove approximately 22.1 acres of forest land, which would be approximately 16.9 acres less than those lands removed by the MP 540 to MP 555 segment. Forest types affected (see Table 5.9-9) would include evergreen forest (21.1 acres) and mixed forest (1.0 acre).

5.9.1.7 Transportation and Utilities Crossed by the Proposed Project

Proposed Action

The proposed Project ROW would cross railroads, utilities (including the Trans Alaska Pipeline System [TAPS]), trails, driveways, and local and arterial roads. As shown in Table 5.9-10, the proposed Project ROW would intersect railroads 13 times. Arterial and local roads would be crossed 47 and 159 times, respectively. In addition, trails/driveways would be intersected 307 times. Utilities would be intersected by the proposed Project ROW 70 times, and the TAPS ROW would be crossed 17 times.

TABLE 5.9-10 Transportation and Utilities Crossed by the Proposed Project (Number)

Segment	Railroads	Arterial	Local	Trail/ Driveway	Utilities	TAPS
Proposed Action						
GCF to MP 540	5	40	98	102	14	17
MP 540 to MP 555	0	0	1	1	2	0
MP 555 to End	5	6	57	199	52	0
Fairbanks Lateral	3	1	3	5	2	0
Proposed Action Total	**13**	**47**	**159**	**307**	**70**	**17**
Denali National Park Route Variation	**2**	**0**	**0**	**0**	**0**	**0**

Denali National Park Route Variation

As shown in Table 5.9-10, the Denali National Park Route Variation would intersect railroad ROWs twice. This segment would not cross roads, trails/driveways, utilities, or the TAPS. In comparison, the MP 540 to MP 555 segment would cross one local road, one trail/driveway, and would cross utilities twice.

5.9.1.8 Agricultural Land and Prime and Important Farmlands

Proposed Action

Construction

As shown in Table 5.9-4, agricultural lands would be least affected by the proposed Project construction ROW and TEWS (11.4 acres; or 0.1 percent of the total construction ROW). Construction of the GCF to MP 540 segment would affect 2.1 acres of cultivated crops, while the MP 555 to End segment would affect 9.3 acres of cultivated crops and 1.0 acre of pasture/hay.

While the construction ROW and TEWS would have minimal effects on agricultural land, the proposed Project would intersect approximately 844 acres of farmland of local importance (see Table 5.9-11). This acreage meets the criteria for Farmlands of Local Importance as established by the Fairbanks Soil and Water Conservation District (SWCD) and the Matanuska-Susitna Borough. No Prime Farmlands, Unique Farmlands, or Farmlands of Statewide importance have been designated in Alaska.

TABLE 5.9-11 Farmland of Local Importance Affected by the Proposed Project ROW (Acres)

Segment	Construction (Temporary)	Operation (Permanent)
Proposed Action		
GCF to MP 540	80.0	20.2
TEWS (GCF to MP 540)	13.9	NA
Fairbanks Lateral	6.2	1.8
MP 540 to MP 555	0.0	0.0
TEWS (MP 540 to MP 555)	0.0	NA
MP 555 to End	670.2	201.3
TEWS (MP 555 to END)	74.6	NA
Proposed Action Total	**844.9**	**223.3**
Denali National Park Route Variation	**0.0**	**0.0**

Note: Calculations include both the area inside and outside the Alaska DOT&PF ROW.

Sources: United States Department of Agriculture Natural Resources Conservation Services (USDA NRCS 2011)

Acreage calculations are based on 100-foot-wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012a. Request for Information 145: Transmittal of Temporary Construct Easement GeoData [TCE_TEW.gdb]).

Yukon River Crossing Options

The construction ROW for the Yukon River crossing options would not affect Farmland of Local Importance.

Operation

The proposed Project permanent ROW would affect approximately 4.0 acres of agricultural land cover (see Table 5.9-5[a]). Operation of the GCF to MP 540 segment would affect less than 1.0 acre of cultivated crops, while the MP 555 to End segment would affect approximately 2.8 acres of cultivated crops and approximately 0.4 acre of pasture/hay. As shown in Table 5.9-11, the permanent ROW would affect approximately 223 acres of farmlands of local importance, with the majority of that acreage (90 percent) affected by the MP 555 to End segment.

Yukon River Crossing Options

The permanent ROW for the Yukon River crossing options would not affect farmland of local importance.

Denali National Park Route Variation

The Denali National Park Route Variation would affect neither agricultural lands nor farmlands of local importance.

5.9.1.9 Existing Zoning

North Slope Borough

North Slope Borough Municipal Code Title 19 addresses land use and zoning. The northern portion of the ROW is zoned by North Slope Borough as Resource Development, while the majority of the ROW within the North Slope Borough is zoned as Transportation Corridor.

The Resource Development (RD) District, according to North Slope Borough code (19.40.080), is "intended to address the cumulative impacts of large scale development, and to offer developers quick, inexpensive, predictable permit approvals. The purpose of the Resource Development District is to accommodate large scale resource extraction and related activities which:

(1) Do not permanently and seriously impair the capacity of the surrounding ecosystem to support the plants and animals upon which Borough residents depend for subsistence;

(2) Are planned, phased and developed as a unit, or series of interrelated units under an approved Master Plan, with provisions made for necessary public and private facilities; and

(3) Meet the policies of the Comprehensive Plan and Coastal Management Program as well as the conditions of approval and special policies imposed on each individual Resource Development District at the time of designation (North Slope Borough Code 19.40.080).

According to North Slope Borough code (19.40.090), the Transportation Corridor District was "established to provide a strip of land to accommodate linear transportation facilities such as roads and pipelines." A development permit is required for development of new transportation facilities, including "gas lines, oil lines, associated roads, pump stations, pipeline maintenance facilities, resource extraction, and necessary supporting developments" within the Transportation Corridor District.

Yukon-Koyukuk Census Area

The Yukon-Koyukuk Census Area is part of the Unorganized Borough, comprising the lands of Alaska not within the boundaries of the state's organized boroughs. Zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Fairbanks North Star Borough

The FNSB Zoning Map and Zoning Code are extensions of the Comprehensive Plan land use categories, and are the administrative tools for implementing land use policies and regulations. Zoning districts establish allowable uses for land. The Fairbanks Lateral would intersect the General Use (GU-1) and Rural Estate (RE-4) land uses. Pursuant to the Zoning Code (Title 18), the installation and maintenance of utility lines are permitted uses in zoning districts.

Denali Borough

The GCF to MP 540, MP 540 to MP 555, MP 555 to End, and Denali National Park Route Variation segments would intersect the Denali Borough (DB). According to the DB Comprehensive Plan, land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (DB 2009). There are no prohibitions on land zoned unrestricted [Ord. 96-04 § 2].

Matanuska-Susitna Borough

The Mat-Su Borough has zoning, land use, and building regulations. Land development in the Borough is subject to MSB Title 17.02, Mandatory Land Use Permit. The Mat-Su Borough has platting authority and a Code Compliance Division. The State Fire Marshal is the State Building Official. While the Mat-Su Borough does not have a Borough-wide zoning code, it regulates land use through special land use districts, residential land use districts, and other mechanisms (STB 2010).

The MP 555 to End segment would intersect the Denali SP SpUD. The construction ROW would intersect 451 acres, while the permanent ROW would intersect 135 acres. Utility substations are conditionally permitted under the SpUD ordinance (17.17.070). Structures, except for signs, are required to be set-back at least 75 feet from the Parks Highway (17.1.110).

5.9.1.10 Existing Land Use Plans

This section summarizes existing land use and land management plans applicable to the proposed Project study area. These plans were reviewed to determine whether the proposed Project would be consistent with them. Table 5.9-13 identifies the relationship between the applicable plans and the proposed Project.

U.S. Bureau of Land Management

Pursuant to Section 202 of the FLPMA, the BLM has developed resource management plans (RMPs) to guide the BLM's management actions on the public lands covered by each plan. The GCF to MP 540 segment (including crossing the Yukon River) intersects BLM lands managed under the guidance of the Utility Corridor and Central Yukon RMPs. Furthermore, the MP 555 to End segment would intersect BLM lands managed under the guidance of the East Alaska RMP. Figure 5.9-2 shows the RMP planning areas within the State of Alaska. In addition, the BLM is the statutorily-designated federal administrator for the Iditarod National Historic Trail (INHT), managed according to the Iditarod National Historic Trail Comprehensive Management Plan (BLM 1986). Finally, the Recreation Management Plan for the Dalton Highway Recreation Management Area (BLM 1991b) guides BLM management of numerous recreation facilities located along the Dalton Highway corridor.

Utility Corridor RMP

The Utility Corridor Proposed Resource Management Plan/ Final Environmental Impact Statement (RMP/FEIS) was designed to provide for multiple uses of planning area resources while also providing resource protection for the approximately 6.1 million acres of BLM administered surface lands (of which 5.8 million acres are BLM-administered mineral estate) within the RMP planning area. An overriding priority of the plan is to preserve the utility corridor for the transportation of energy minerals (BLM 1989). Both the inner and outer corridors within the RMP planning area are designated as FLPMA section 503 ROW corridors under 43 C.F.R 2806.2. The RMP establishes 13 Area of Critical Environmental Concern (ACECs) and five Special Recreation Management Areas (SRMAs), and recommends the upper Nigu River areas for inclusion in the NWPS (BLM 1991a).

Within the RMP planning area, the proposed Project would intersect the Galbraith Lake ACEC and the Toolik Lake RNA. At approximately 56,000 acres, Galbraith Lake ACEC is managed for the preservation of cultural resources, rare/sensitive plants, scenic values, and lambing areas. As both an RNA and ACEC, Toolik Lake RNA (approximately 82,800 acres) is managed for research activities and the preservation of cultural resources. The Dalton Highway and the TAPS both cross the RNA. The RMP specifies that management of the ACECs will not restrict existing or future energy transportation systems.

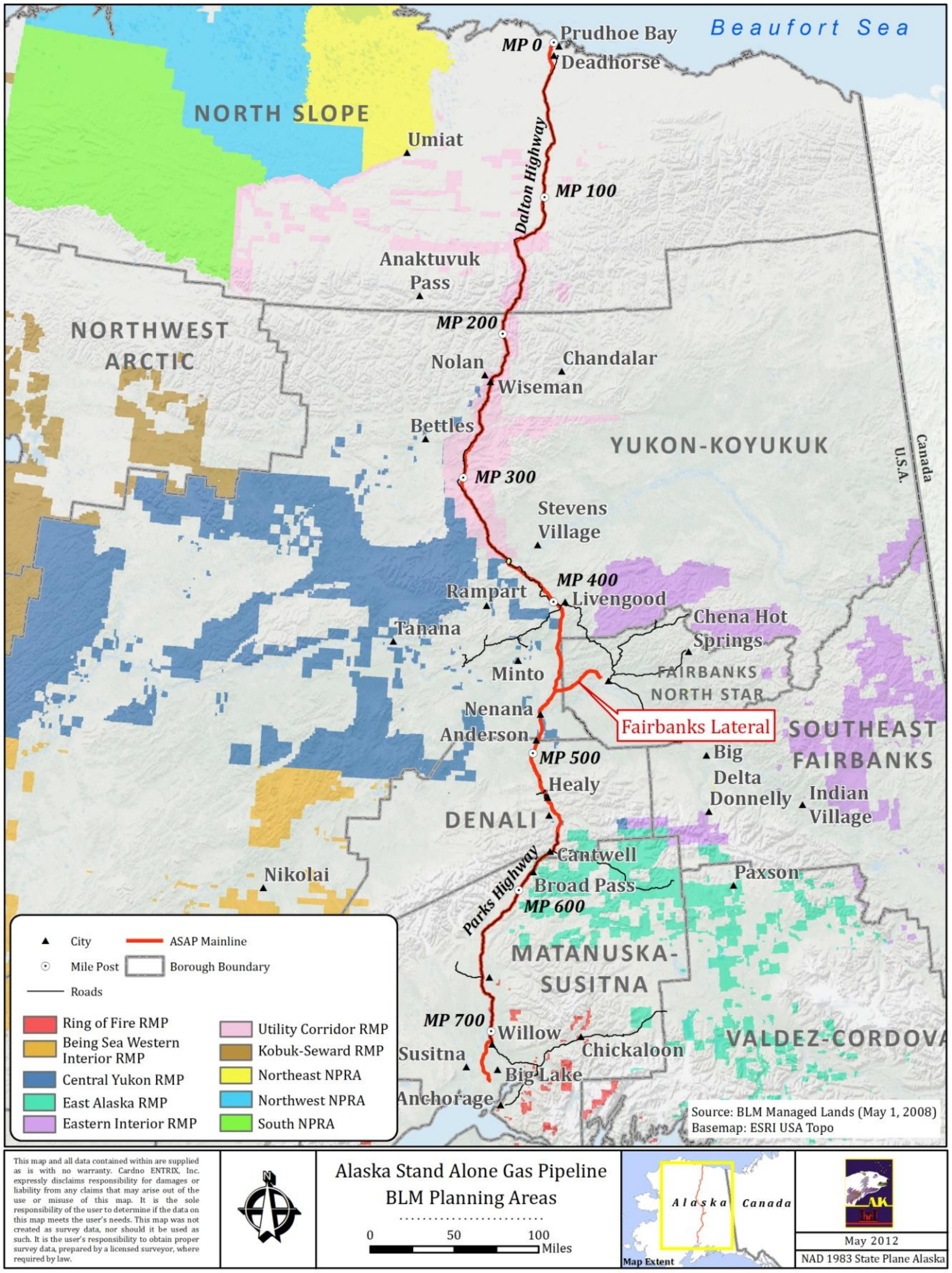

FIGURE 5.9-2 BLM Planning Areas

Central Yukon RMP

The Central Yukon RMP guides management of 9.5 million acres in west-central Alaska. Under the RMP, the Central Yukon Planning Area is managed for resource development, subsistence, commercial use, and protection of environmental resources. The majority of lands within the planning boundary are open to mineral leasing and mineral location. The plan designates ACECs and eight Research Natural Areas for inclusion within the Ecological Reserve System (BLM 1986).

East Alaska RMP

The East Alaska RMP/FEIS guides management of 7.1 million acres in eastern Alaska, including approximately 5.5 million acres that are selected by the State of Alaska or Alaska Natives. Under the RMP, the East Alaska Planning Area is managed to protect and enhance vegetative communities; fish and wildlife resources; natural, cultural, and geological resources; and recreational opportunities. In addition, the planning area is managed to protect and prevent damage to public land resources and to enhance those resources where feasible. The RMP designated the Bering Glacier Research Natural Area, five SRMAs, specific trails, and developed restrictions on OHVs and snowmobile usage (BLM 2007).

Iditarod National Historic Trail Comprehensive Management Plan

The Iditarod National Historic Trail Comprehensive Management Plan is a Congressionally-mandated management plan for the collection of trail resources collectively known as the "Iditarod National Historic Trail" (INHT). Under the plan, no single agency or organization manages the entire trail; instead, the plan calls for cooperative management by federal, state, and local agencies. The plan establishes a common guide used to promote the preservation, enjoyment, use, and appreciation of the trail. It also identifies trails and sites comprising the historic trail system, and recommends possible management actions for protecting significant segments, historic remnants, and artifacts for public use and enjoyment. The BLM coordinates the cooperative management of the INHT land and is the primary point of contact for matters involving the entire trail. The BLM's duties under the plan include reviewing for appropriateness and consistency any draft regulations affecting segments of the INHT. State, city, municipal, or borough land managers responsible for trail segments or historic sites identified in the plan are encouraged to enter into cooperative agreements with the Federal government and to collaboratively define actions that are consistent with the plan's management objectives on a segment-by-segment or site-by-site basis (BLM 1986, STB 2010). The MP 555 to End segment would intersect the INHT at MP 732.6.

Recreation Management Plan for the Dalton Highway Recreation Management Area

The Dalton Highway Recreation Management Area (DHRMA) includes those public lands adjacent to the Dalton Highway from a point near the confluence of the Sagavanirktok and Ivishak rivers (about 60 miles south of Prudhoe Bay) and extending south to the Yukon River. The approximately 1.1 million acre DHRMA is managed by the BLM in accordance with the Recreation Management Plan for the Dalton Highway Recreation Management Area (BLM 1991b), with an overall management objective of providing for a variety of developed and semi-primitive motorized recreation opportunities. The GCF to MP 540 segment would parallel the Dalton Highway corridor from the North Slope to near Livengood.

National Park Service

Lands administered by the NPS in the vicinity of the proposed Project ROW include the Gates of the Arctic NPP and the Denali NPP. The GCF to MP 540 segment would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. However, the Denali National Park Route Variation would intersect the boundary of the Denali NPP. U.S. Congressional approval to construct and operate a gas pipeline through the Denali NPP would therefore be required (see the discussion in Section 5.9.1.1).

At 6 million acres, the Denali NPP is one of the largest national parks in the United States. The park includes a designated wilderness area and an international biosphere reserve. The park is managed according to the Consolidated General Management Plan (NPS 2008).

The 8.4-million acre Gates of the Arctic NPP is the central component of a 700 square mile portion of the Brooks Range. The ANWR is to the east, and the Noatak Preserve is to the west. The park is managed according to the 1986 General Management Plan, which the NPS is currently in the process of amending (NPS 2011).

United States Fish & Wildlife Service

The GCF to MP 540 segment is greater than 0.2 mile from the ANWR and the Yukon Flats NWR, both of which are administered by the USFWS. Long-term management of each NWR is guided by a Comprehensive Conservation Plan (CCP).

The original CCP for the ANWR was signed into effect in 1988, and is currently being revised by the USFWS. In the revised CCP, the USFWS will conduct wilderness reviews of most non-wilderness lands in the ANWR, including those within the coastal plain (USFWS 2010).

The Yukon Flats NWR CCP recommended 650,000 acres (8 percent of the refuge) in the White-Crazy Mountains for wilderness designation. The Secretary of the Interior has not yet submitted the recommendation to the President, who would then submit it to the U.S. Congress for action. While the CCP does not directly address transportation or utility ROWs, the plan designates refuge lands in the minimal management category (USFWS 1987).

State of Alaska

Alaska Department of Natural Resources

State plans applicable to the proposed Project area include the Dalton Highway Master Plan, Tanana Valley State Forest Plan, North Slope Site-Specific Plan, Southeast Susitna Area Plan, Susitna Area Plan, the Public Review Draft Susitna Matanuska Area Plan, the Susitna Basin Recreation Rivers Management Plan, the Tanana Basin Area Plan, Willow Creek State Recreation Area Master Plan, Denali State Park Management Plan, and the Scenic Resources Along the Parks Highway — Inventory and Management Recommendations.

For those lands that are owned by the ADNR, but not covered by a land management plan, the ADNR, in coordination with the public, identifies important land resources and how their lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible, multiple uses are allowed on these lands.

Tanana Valley State Forest Management Plan

The Tanana Valley State Forest's (TVSF) 1.81 million acres lie almost entirely within the Tanana River Basin, located in the east-central part of Alaska. The TVSF is open to mining, gravel extraction, oil and gas leasing, and grazing, although these activities are not frequently conducted. Timber production is the major commercial activity. The Bonanza Creek Experimental Forest, a 12,400-acre area dedicated to forestry research, is also located within the TVSF. Management of the TVSF is guided by the Tanana Valley State Forest Management Plan 2001 Update (ADNR 2001b).

North Slope Site-Specific Plan

The ADNR is currently developing a plan that may classify up to 32,000 acres and will identify lands that are suitable for conveyance to the North Slope Borough.

Susitna Matanuska Area Plan

The ADNR has revised the state land use plan for over 9 million acres of state land in the Susitna and Matanuska River Valleys. The Susitna Matanuska Area Plan (SMAP) revises the majority of the 1985 SMAP, encompassing most of the land within the Matanuska-Susitna Borough. The SMAP designates primary uses on state land, provides general management guidelines for a variety of land uses and resources, and identifies specific management intent for individual units of land (ADNR 2010).

Southeast Susitna Area Plan

The Southeast Susitna Area Plan establishes land use designations, management intent, and management guidelines for more than 250,000 acres of state uplands, shorelands, and tidelands in the lower Susitna Valley. This plan supersedes the 1982 Willow Sub-Basin Area Plan, a portion of the 1985 South Parks Highway Subregion of the Susitna Area Plan, the 1989 Deception Creek Land Use Plan, and the 1991 Kashwitna Management Plan (ADNR 2008).

Susitna Basin Recreation Rivers Management Plan

The Susitna Basin Recreation Rivers Management Plan governs land and water management practices for state-owned lands along the Little Susitna State Recreation River, including water and riparian habitats and a 1 mile wide corridor of land surrounding the rivers. The plan includes goals and management practices for recreation, fish and wildlife habitat, and public access, among others (ADNR 1991).

Tanana Basin Area Plan

The Tanana Basin Area Plan guides management of approximately 14.5 million acres of state-owned land and 1.7 million acres of federal land selected for conveyance to the state in the

Tanana Basin. The plan designates surface and subsurface uses for each management unit within the seven major planning regions (ADNR 1986).

Willow Creek State Recreation Area Master Plan

The 1990 Willow Creek State Recreation Area (WCSRA) Master Plan designates compatible and incompatible uses, prioritizes the development of recreational facilities, and provides general guidelines for the management of recreational activities within the approximately 3,583 acre WCSRA. All lands within the WCSRA are managed for natural, cultural, or recreational development (ADNR 1990).

Susitna Area Plan

The 1985 Susitna Area Plan provided area-wide land management policies, land use designations for specific sites, priorities for implementing, and procedures for review and amendments within an approximately 15.8 million acre planning area (ADNR 1985). The majority of the plan has since been superseded by the SMAP and the Southeast Susitna Area Plan; however, the MP 555 to End segment intersects an area still guided by the Susitna Area Plan.

Denali State Park Management Plan

The 325,240-acre Denali State Park (SP) is bisected by the George Parks Highway and bordered on the west by the Denali NPP. The Alaska State Legislature created Denali SP (AS 41.21.150-152) in 1970 for the purposes of tourism related development, the provision of recreational opportunities for Alaskans, and the preservation of the area's natural resources. The ADNR Division of Parks and Outdoor Recreation manages park lands and development of recreational facilities according to the Denali SP Management Plan. Primary uses of the park are camping, hiking, fishing, viewing Denali, canoeing, rafting, river boating, hunting, and trapping (ADNR 2006).

Dalton Highway Master Plan

The Dalton Highway extends from its junction with Elliott Highway one mile west of Livengood up to Deadhorse Airport, 414 miles north. The highway is operated and maintained by the Alaska DOT&PF. The Dalton Highway Master Plan, released by the ADNR Division of Mining, Land & Water in 1998, guides management of the highway. The highway is managed for economic development, public safety, and natural resource management. The plan includes mitigation measures and recommendations related to fish and wildlife concerns, off-road access, and future travel impacts (Dalton Highway and Advisory Planning Board 1998).

Alaska Department of Fish & Game

The Minto Flats State Game Refuge Management Plan contains policies related to transportation/utility corridors through the refuge (ADF&G 1992). The Palmer Hay Flats State Game Refuge Revised Management Plan does not provide guidance specific to the development of material sites (ADF&G 2002). A transportation and utility corridor has been excluded from the Palmer Hay Flats State Game Refuge; however, the material site would be located outside of this corridor.

The Minto Flats State Game Refuge and the Palmer Hay Flats State Game Refuge are the only ADF&G-managed units that would be transected by proposed Project facilities. Other special areas managed by ADF&G that would be within the vicinity of the proposed Project features, but would not be transected by the proposed Project facilities, are discussed in Section 5.10, Recreation.

Local

North Slope Borough

The North Slope Borough asserts jurisdiction over activities within its boundaries on private and state-owned lands. The North Slope Borough adopted a Comprehensive Plan for the Borough on October 11, 2005. The North Slope Borough is in the process of developing comprehensive land use plans for the North Slope villages. None of these villages would be intersected by the proposed Project.

Yukon-Koyukuk Census Area

The GCF to MP 540 segment and the Fairbanks Lateral both would intersect the Yukon-Koyukuk Census Area. This Census Area is part of the Unorganized Borough comprising the lands of Alaska not within the boundaries of the state's organized boroughs. Planning and zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

Nenana

The City of Nenana does not have rigorous land use or zoning designations. Development within the City requires mayoral approval of a Land Use Permit (J. Mayrand Pers. Comm. 2010).

Fairbanks North Star Borough

The Fairbanks Lateral would intersect the FNSB, which has developed comprehensive zoning, planning, and land use regulations. The FNSB Planning and Zoning regulations apply outside of incorporated areas within the Borough. The FNSB Regional Comprehensive Plan establishes goals, strategies, and actions for the Borough's land uses. The Comprehensive Plan provides land use guidance through its land use map and land use category designations (FNSB 2005). Comprehensive Plan land use categories that would be crossed by the Fairbanks Lateral are shown in Table 5.9-12.

The Vision Fairbanks Downtown plan is an element of the Comprehensive Plan and guides development of the downtown core area (FNSB 2008). The downtown planning area would not be intersected by the proposed Project.

TABLE 5.9-12 FNSB Regional Comprehensive Plan Land Categories Intersected by the Proposed Project

Land Category	Definition
Reserve Area	Area to be reserved under public ownership until sufficient data is available to make definitive planning judgments. Permitted uses include mining, hunting, fishing, trapping, recreation, forestry, and agriculture. No foreseeable development plans, but development is possible.
Preferred Agricultural Land	Land consisting of well-drained agricultural soils, located at elevations of less than 1,200 feet, on slopes that are farmable and outside of the URBAN and PERIMETER areas, but with proximity to transportation and markets.
High Mineral Potential	Areas in the RURAL and OUTSKIRT areas that have been identified as having a high potential for mineral deposits. The priority land use in these areas is mining. Land uses incompatible with mining are discouraged.

Source: Fairbanks North Star Borough Community Planning Department 2005.

Denali Borough

The GCF to MP 540, MP 540 to MP 555, MP 555 to End, and Denali National Park Route Variation segments would intersect the Denali Borough (DB). According to the DB Comprehensive Plan, land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (DB 2009). There are no prohibitions on land zoned unrestricted (Ord. 96-04 § 2).

Matanuska-Susitna Borough

As described within the subsection Regulatory Setting above, the Mat-Su Borough Wide Comprehensive Plan provides general goals and policy recommendations for a 20 year period to address development patterns, technological advances, a growing population, and a diversifying economy (Mat-Su Borough 2005a).

The MP 555 to End segment would pass through the communities of Trapper Creek, Susitna, Willow, Big Lake, and Point MacKenzie. Each of their community councils currently has or is developing a comprehensive plan. These community comprehensive plans are consistent with the general goals and recommendations of the Mat-Su Borough Wide Comprehensive Plan.

Trapper Creek Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Trapper Creek Community Council. The council is currently developing the Trapper Creek Community Council Comprehensive Plan.

Susitna Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Susitna Community Council. The Susitna Community Council Comprehensive Plan guides the use of public and private lands, and directs community and agency decisions about improvements to roads, trails, and other public services and facilities. The plan also establishes strategies for economic development, environmental protection, and improved local governance (Mat-Su Borough 2005b).

Willow Area Community Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Willow Community Council. The Willow Area Community Comprehensive Plan, currently in draft form, was developed by the

Willow Community Council to provide for planned and orderly growth in the Willow area while enhancing economic opportunities, respecting individual property rights, and preserving the area's scenic, recreational, rural, agricultural, and residential qualities (Mat-Su Borough 2009).

Big Lake Community Council Area Comprehensive Plan Update

The MP 555 to End segment and the Cook Inlet Natural Gas Liquid Extraction Plant (NGLP) would intersect land managed by the Big Lake Community Council. The Big Lake Community Council Area Comprehensive Plan Update was developed by the Big Lake Community Council to address the challenges and opportunities facing the community by establishing broad goals and policies intended to guide growth over the next 10 to 20 years (Big Lake Community Council 2009).

Draft Point MacKenzie Community Council Comprehensive Plan

The MP 555 to End segment would intersect land managed by the Point MacKenzie Community Council. The Point MacKenzie Community Council Comprehensive Plan, currently in draft form, was developed by the Point MacKenzie Community Council to guide the community's growth and development through the year 2030 by addressing the multitude of issues facing the community, ranging from land use, to economic development, to public facilities, and more (Mat-Su Borough 2010).

5.9.2 Environmental Consequences

5.9.2.1 No Action Alternative

The No Action Alternative would have no effect on existing land ownership and uses because the proposed Project would not be constructed.

5.9.2.2 Proposed Action

Effects to Land Use Planning

As described above, the proposed Project would intersect lands managed according to numerous federal, state, borough, and local management plans. Table 5.9-13 below describes the consistency of the proposed Project with existing land use and management plans and shows the acreage affected within each planning boundary. With the exception of the Denali NPP and 6(f) lands, all other lands with applicable land use plans or documents would have provisions for utility crossings; therefore, the proposed Project would be compatible with these plans.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
Bureau of Land Management	Utility Corridor Resource Management Plan/Environmental Impact Statement Record of Decision (1991)	GCF to MP 540: Construction = 2,912 acres TEWS = 338 acres Operation = 1,439 acres **Yukon River Crossing Options:** Construction = 2 acres Operation = 0 acre	MP 123.5 to 240.5 MP 248.2 to 360	The proposed RMP/Final EIS identifies the Inner and Outer portions of the Utility Corridor within its planning area. The proposed Project would be located within the Utility Corridor. The primary management direction and use of BLM-administered lands in the Utility Corridor is for energy transportation. In addition to the Management Practices and Allowable Uses for the Galbraith Lake ACEC and Toolik Lake RNA, the protection measures and stipulations detailed in Appendices K and L of the proposed RMP/Final EIS would apply in the event that the BLM granted the ROW authorization for the proposed Project.
	Resource Management Plan and Record of Decision for the Central Yukon Planning Area (1986)	GCF to MP 540: Construction = 53 acres TEWS = 6 acres Operation = 17 acres **Yukon River Crossing Options:** Construction = 3 acres Operation = 1.6 acres	MP 359.8 to 360.5 MP 490.5 to 491.5 MP 529.4 to 532	The following policies would apply to access to or across BLM lands managed under the RMP: Access to or across public lands will be considered on a case-by-case basis. Under this RMP, the use of vehicles of greater than 1,500 pounds GVW will be allowed by authorization only. Vehicle use may be authorized under a mining plan of operations (43 CFR 3809), with a permit (43 CFR 2800 or 43 CFR 2920), or by other appropriate means. Approval would be subject to conditions that minimize the impact to other land uses and/or prevent unnecessary damage to the environment.
	East Alaska RMP (2006)	MP 555 to End: Construction = 86 acres Operation = 23.7 acres	MP 570.4 to 577.1	The required operating procedures and oil and gas leasing stipulations described in Appendix C of the RMP/Final EIS would apply in the event that the BLM granted the ROW authorization for the proposed Project.
	Iditarod National Historic Trail Comprehensive Management Plan (1986)	Intersected by MP 555 to End segment	MP 732.6	The plan does not provide guidance related to utility corridors.
	Dalton Highway Recreation Area Management Plan (1991)	GCF to MP 540: Construction = 3,758 acres TEWS = 417 acres Operation = 1,696 acres	MP 63 to 360	The plan states that "the primary function of the lands within the DHRMA is the transportation of energy resources; therefore, actions or activities potentially adverse to existing and future energy transportation systems will be avoided. Mineral material extraction is allowed within the DHRMA for maintenance and construction of transportation systems. This planning decision may be in conflict with recreation management objectives in some areas."
National Park Service	Denali National Park & Preserve Consolidated General Management Plan (2008)	**Denali National Park Route Variation:** Construction = 82 acres Operation = 30 acres	MP 539.6 to 554.9	The proposed Project would be inconsistent with the purposes for which the Denali NPP is to be managed, as established by Sections 101 and 202 of ANILCA. Transportation systems that are proposed to cross a CSU created or expanded by ANILCA require an act of Congress if such transportation system would cross any Congressionally designated wilderness area, or if there is no existing authority for granting a ROW for the particular type of transportation system proposed, such as a natural gas pipeline across NPS units in Alaska. Current legislation proposed by Alaska Senators Begich and Murkowski, 'The Denali National Park and Preserve Natural Gas Pipeline Act', would allow a pipeline through the park.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
	Gates of the Arctic National Park & Preserve General Management Plan (1986)	Not applicable	Not applicable	The proposed Project ROW would not intersect the boundaries of this CSU.
U.S. Fish & Wildlife Service	Yukon Flats National Wildlife Refuge Comprehensive Conservation Plan (1987)	Not applicable	Not applicable	The proposed Project ROW would not intersect the boundaries of this CSU.
	Arctic National Wildlife Refuge Comprehensive Conservation Plan (1988; under revision)	Not applicable	Not applicable	The proposed Project ROW would not intersect the boundaries of this CSU.
Alaska Department of Natural Resources	Tanana Valley State Forest Management Plan 2001 Update	GCF to MP 540: Construction = 179 acres TEWS = 10 acres Operation = 54 acres Fairbanks Lateral: Construction = 20 acres Operation = 6 acres		The plan contains the following policies relevant to the proposed Project: Other land management proposals may be initiated by other agencies or private individuals and may include requests for rights-of-way, commercial leases, timber or material sales, or permits for mineral activity, trapping cabins, or grazing. The following process will be used to review these permit or conveyance requests. Applications for use of State Forest land, including mining or prospecting, will be forwarded to the Northern Regional Office of the Division of Mining, Land and Water. The Division of Mining, Land and Water will distribute the applications for review by agencies, including the Northern Regional Office of the Division of Forestry. The Division of Forestry will review applications for consistency with this plan and other existing laws and policies. The Division of Forestry will then return applications to the Division of Mining, Land and Water with stipulations for processing. The Division of Forestry may also require additional review of applications after interagency or public comment. Although preliminary decisions or final findings will continue to be made by the Division of Mining, Land and Water, applications must be consistent with the stipulations given by the Division of Forestry. No permits, leases, disposals, or rights-of-way will be authorized for use of State Forest land that are not consistent with stipulations from the Division of Forestry. **TIMBER MANAGEMENT** **II. MANAGEMENT GUIDELINES** **H. Salvage of Timber From Land Clearing** Timber with commercial or personal use values should be salvaged from lands that are to be cleared for other uses such as mining, transportation or utility corridors, and habitat enhancement projects, where feasible and prudent. See Chapter 1 for

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				statutory direction for the Tanana Valley State Forest. **TRAILS** **G. Trail Crossings** **II. MANAGEMENT GUIDELINES** When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses a trail corridor. **PUBLIC ACCESS** **I. GOALS** Maintain, enhance, or provide adequate access to publicly-owned land and resources. **II. MANAGEMENT GUIDELINES** **J. Pipeline Crossings** The ADNR should work with Alyeska Pipeline Service Company to identify options to develop new pipeline crossings. Future pipelines (such as the Trans-Alaska Gas Line) should provide more places for public crossings to state land for hunting, fishing, recreation, timber harvest, settlement, and other uses or provide a mechanism to improve or develop future public crossings as the need arises.
	North Slope Site Specific Plan	GCF to MP 540: Construction = 2,402 acres TEWS = 201 acres Operation = 848 acres	MP 0 to 186.8	The plan is under development.
	Susitna Matanuska Area Plan (February 2010 Public Review Draft)	MP 555 to End: Construction = 753 acres TEWS = 88 acres Operation = 226 acres	MP 575.5 to 681	The SMAP specifies land management policies for each of the 11 regions within the plan boundaries. The MP 555 to End segment would intersect the North Parks Highway, Petersville Road, and Susitna Lowlands regions. Prior to making an authorization decision, the ADNR takes into account the management guidelines and statement of intent specific to each unit within a region. The SMAP emphasizes minimizing land use conflicts through plan guidelines and intent rather than through prohibitions, although prohibitions are sometimes identified. Other uses are initially presumed compatible with the primary use. However, if the ADNR determines that a use conflict exists and that the proposed use is incompatible with the primary use, the proposed use shall not be authorized or it shall be modified so that the incompatibility no longer exists (11 AAC 55.040 (c)). The Area-wide Land Management Policies include management guidelines relevant to pipeline development: **Shorelands and Stream Corridors**

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				C. Public Access Adjacent to Waterbodies. Pursuant to AS 38.05.127, legal public access will be reserved to protect the public's right to travel to and along the ordinary high water (OHW) of a waterbody without encouraging trespass. Permits, leases, and plans of operation for commercial and industrial uses, transportation facilities, pipelines and other water dependent uses may be authorized on state uplands adjacent to waterbodies if their activities are consistent with the management intent for the area and if they maintain tideland and stream bank access, and protect important fish and wildlife habitat, public water supplies, and public recreation. Trails and other forms of non-motorized public access are generally considered to be appropriate within these areas, if they meet the conditions listed in 11 AAC 96.025. **H. Buffer, Easement, and Building Setback Widths**. d) Public access easements, including 'to and along' easements required under AS 38.05.127, or utility easements adjacent to tidelands, lakes, and streams: 50 feet. Other types of utility easements may be less than this width, depending on the purposes of the easement. Public Access **F. Alignment with Crossings**. When it is necessary for power lines, pipelines or roads to cross trails, crossings should be at a 90-degree angle. Vegetative screening should be preserved at trail crossings.
	Southeast Susitna Area Plan (2008)	MP 555 to End: Construction = 748 acres TEWS = 108 acres Operation = 384 acres	MP 681 to 736.4	The Area-wide Land Management Policies include management guidelines relevant to pipeline development. These guidelines are identical to those found in the SMAP (see above).
	Susitna Area Plan (1985, as amended)	MP 555 to End: Construction = 1,416 acres TEWS = 168 acres Operation = 425 acres	MP 647 to 736.4	The Area-wide Land Management Policies listed in the plan include management guidelines relevant to pipeline development: **Forestry** **2. Management Guidelines** **B. Timber Salvage**. Timber with commercial or personal use value should be salvaged from lands that are to be cleared for other uses, such as farms and transportation or utility corridors. Trail Management **G. Trail Crossings**. When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses a trail corridor.
	Susitna Basin Recreation	MP 555 to End:	MP 729 to 731	The plan includes goals and management practices for recreation, fish and wildlife

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
	Rivers Management Plan (1991)	Construction = 10 acres TEWS = 1 acre Operation = 3 acres		habitat, and public access, among others. There is no specific mention of management guidelines relevant to pipeline development.
	Tanana Basin Area Plan (1986)	GCF to MP 540: Construction = 1,887 acres TEWS = 179 acres Operation = 533 acres Fairbanks Lateral: Construction = 449 acres TEWS = 29 acres Operation = 125 acres MP 540 to MP 555: Construction = 491 acres TEWS = 29 acres Operation = 57 acres MP 555 to End: Construction = 312 acres Operation = 78 acres **Denali National Park Route Variation:** Construction = 185 acres Operation = 61 acres	MP 395.5 to 575.6 (Mainline) MP 0 to 34.4 (Fairbanks Lateral)	The Area wide Land Management Policies listed in the plan include management guidelines relevant to pipeline development: Trail Management **G. Trail Crossings**. When it is necessary for powerlines, pipelines, or roads to cross trail corridors, crossings should be at 90-degree angles when feasible. An exception is when a trail corridor is deliberately combined with a public utility or transportation corridor. Where feasible, vegetative screening should be preserved when a utility crosses or co-locates within a trail corridor. In addition, the Transportation Goals specified in Chapter 2 apply to forms of utility or resource transportation corridors. The following transportation corridors were identified in the plan: ▪ Alaska Natural Gas Pipeline ▪ Alaska Railroad Extension ▪ Prince William Sound - Upper Tanana Railroad Corridor ▪ Western Access Railroad Corridor ▪ Twin Mountain Access Route ▪ Parks Highway - Kantishna – McGrath Highway Corridor ▪ Upper Wood River (Bonnifield Mining District) Access ▪ Nenana - Totchaket Area Access ▪ TAPS Oil Spill Contingency Plan Access Routes ▪ Existing transportation routes identified by the plan include the RS2477 trails and existing highways maintained and operated by Alaska DOT&PF. ▪ Utility corridors are prohibited within the following units: ▪ Management Unit 2H: Minto ▪ Management Unit 3B: South Shore Lake Minchumina ▪ Management Unit 3E: Middle Cosna-Zitziana Watersheds
	Willow Creek State Recreation Area Master Plan (1990)	MP 555 to End: Construction = 18 acres TEWS = 2 acres Operation = 5 acres	MP 707.7 to 709.2	The highest level of development permitted within the park includes but is not limited to roads, trails, and public transportation routes or access. Exceptions to the provisions of the master plan may be made without modification to the plan. Special exceptions can occur only when complying with the plan is excessively difficult or impractical and a practical alternative procedure can be implemented which adheres to the purposes and spirit of the plan.
	Denali State Park Management Plan (2006)	MP 555 to End: Construction = 451 acres TEWS = 40 acres	MP 608.6 to 645.7	The plan designates land use within park boundaries. Land use designations adjacent to the Parks Highway consist of Natural Area and Recreation Development. Areas designated Natural Area are intended to be relatively

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
		Operation = 135 acres		undeveloped and provide users opportunities for a high value, natural experience. Figure 11 within the plan provides guidelines for activities and facilities within the various land-use designations in the park. For both the Natural Area and Recreation Development designations, utilities, transmission lines, and pipelines are allowable by permit only when no viable alternative exists. Tower heights are limited to 85 feet. Best practices must be employed to minimize impacts to viewsheds, especially within the viewsheds of areas with high public use.
	Dalton Highway Master Plan (1998)	GCF to MP 540: Construction = 5,048 acres TEWS = 523 acres Operation = 2,084 acres	MP 0 to 405	The plan specifies development nodes along the Dalton Highway Corridor at the following locations: Yukon River Crossing, Coldfoot, Chandalar Shelf, Happy Valley and Deadhorse. Each node is a distinct and compact cluster of development. Oil and gas development activities, transportation, and incidental or minor governmental activities are allowed to locate outside of nodes if the needs of the activity are demonstrably better met outside the nodes.
	Scenic Resources Along the Parks Highway – Inventory and Management Recommendations (1981)			See the Visual Resources portion of this report (Section 5.12) for a discussion of this plan's applicability to the proposed Project.
Alaska Department of Fish & Game	Minto Flats State Game Refuge Management Plan (1992)	GCF to MP 540: Construction = 287 acres TEWS = 35 acres Operation = 86 acres	Intermittently between MP 418.5 to 455.5	The Minto Flats State Game Refuge Management Plan contains policies related to transportation/utility corridors through the refuge: Transportation and utility corridors, including railroads, roads, powerlines, and pipelines may be sited on refuge lands if they are determined to be compatible with the purposes for which the refuge was established. Proposals will be evaluated for compatibility with the refuge purposes listed in legislation and reflected in the goals of this plan: 1) protection and enhancement of habitat resources; 2) conservation of fish and wildlife populations; and 3) the continuation of fishing, hunting, trapping, and other public uses compatible with habitat protection and enhancement and fish and wildlife conservation. Additionally, corridor proposals must demonstrate that there is a significant public need for the corridor that cannot be reasonably met off-refuge, that the use of refuge lands and impacts to refuge resources are avoided or minimized to the maximum extent feasible, that public access to the refuge is maintained, and that impacts to refuge resources are fully mitigated. Given the distribution of habitats and public uses within the refuge, the potential for incompatibility between corridor development and resource values appears to be greater within the portion of the refuge north of the Tanana River. Therefore, the highest priority should be given to avoiding the future siting of transportation and utility corridors in the most valuable refuge habitats north of the Tanana River.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
	Palmer Hay Flats State Game Refuge Revised Management Plan (2002)	Location of a proposed material site	N/A	The plan does not provide guidance specific to the development of material sites. A Special Area Permit is required for any construction work, including any habitat altering activity on state land or water, in a designated State Game Refuge (5 AAC 95.420). The ADF&G Habitat Division reviews all proposed activities for consistency with the Management Plan and with regulation 5 AAC 95.505. Activities will be approved, conditioned, or denied based on the direction provided in the Management Plan.
North Slope Borough	North Slope Borough Comprehensive Plan (2005)	GCF to MP 540: Construction = 2,402 acres TEWS = 201 acres Operation = 848 acres	MP 0 to 186.8	The North Slope Borough Comprehensive Plan contains policies related to the development of oil and gas resources: **Issue #32:** Drill pads and pipelines encroach upon subsistence zones. <u>Goal:</u> Minimize impacts to subsistence from development, sport hunting, and other outside influences. *Objective/Policy:* Coordinate with village residents to reduce the footprint of development and encourage common use of facilities. *Objective/Policy:* Mitigate impacts to subsistence from development. *Objective/Policy:* Develop a program to compensate village residents for impacts to subsistence. **Issue # 81:** Development activities can impact fish and wildlife populations, habitat, and their capacity to continue to support subsistence activities. <u>Goal:</u> Minimize habitat fragmentation from construction of resource development infrastructure that impacts migratory patterns of fish and wildlife. <u>Goal:</u> Encourage development to use best available technology to reduce adverse impacts of fish and wildlife. *Objective/Policy:* Coordinate with the Borough and local residents when preparing resource development plans to avoid or reduce impacts to fish and wildlife. *Objective/Policy:* Monitor fish and wildlife populations and habitat before, during, and after development activities to document impacts. *Objective/Policy:* Incorporate measures such as buried pipelines, common rights-of-way, and directional drilling to minimize adverse effects on fish and wildlife migration and habitat. **Issue #90**: A small percentage of local residents are presently employed by outside companies <u>Goal:</u> Increase local hire in outside companies, such as the oil and gas industry. **Issue #118:** Resource development changes the character of the landscape and alters the way local people use the land. <u>Goal</u>: Minimize visual and other impacts on community character. *Objective/Policy:* Locate and design oil and gas facilities to minimize visual and other impacts on community character. **Issue #156:** Oil field infrastructure, including roads, pads, and pipelines cause

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				physical changes in the environment. Goal: Minimize physical changes in the environment from oil field infrastructure. *Objective/Policy:* Work with industry in the permitting process to incorporate mitigation measures that reduce impacts (Section 5.23). *Objective/Policy:* Develop incentives for industry to develop alternative designs to minimize development footprint and consolidate facilities. **Issue #160:** There is a lack of regulations for oil and gas pipelines. Goal: Develop and implement state regulations for oil and gas pipeline installation, operation, and maintenance. *Objective/Policy:* Develop agreements with the state for minimum criteria and inspections. *Objective/Policy:* Bring public attention to the issue to encourage development of state regulations for pipelines. **Issue #162:** Communities are concerned about the potential impacts of demobilizing oil and gas facilities in the future. Goal: Require industry to rehabilitate oil and gas facility sites as resources are depleted. Goal: Assure adequate funds and resources for demobilization and restoration activities are established. *Objective/Policy:* Encourage public participation in demobilization planning. *Objective/Policy:* Enforce existing permit requirements for demobilization. *Objective/Policy:* Monitor demobilization efforts. *Objective/Policy:* Work with federal and state agencies to ensure that adequate funds and resources for demobilization and restoration activities are being reserved. **Issue #42:** The resource industry does not adequately coordinate with local subsistence users prior to development or dismantlement of oil and gas facilities. Goal: Improve coordination with local subsistence users prior to development and dismantlement activities. *Objective/Policy:* Use the Kuukpik Subsistence Oversight Panel (KSOP) as a model for improving coordination and local participation in planning for and monitoring resource exploration and development activities. *Objective/Policy:* Investigate other models for coordinating subsistence and resource development, including Canadian hunting and trapping associations. **Issue #57:** State and federal government entities and the oil and gas industry do not fully understand the importance of traditional and contemporary local knowledge to Borough residents. Goal: Recognize the importance of cultural values and traditional and contemporary local knowledge to Borough residents.

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
				Objective/Policy: Educate state, federal, and local government entities and the oil and gas industry about the importance of traditional and contemporary local knowledge to Borough residents. *Objective/Policy:* Develop a handbook for government entities and the oil and gas industry that relays the importance and utilization of traditional and contemporary local knowledge. *Objective/Policy:* Seek out and incorporate aspects of traditional and contemporary local knowledge during proposed Project design, permitting, and environmental impact assessments. **Issue #97:** Borough communities are not energy self-sufficient. <u>Goal</u>: Develop energy strategies for the villages to achieve greater self-sufficiency. *Objective/Policy*: Develop alternative energy sources for Borough communities, such as coal, natural gas, and wind power. *Objective/Policy*: Look for ways that oil and gas development can provide natural gas to village communities. **Issue #165:** Some communities close to natural gas resources do not have supply facilities. **Issue #166:** It is expensive to develop natural gas facilities for supply and distribution to small communities. <u>Goal:</u> Develop gas supply facilities in communities within close proximity to natural gas. <u>Goal:</u> Obtain grants and other funding sources to develop supply and distribution facilities. *Objective/Policy*: Identify communities for potential gas supply development. *Objective/Policy*: Develop business relationships with funding partners and the resource development industry. *Objective/Policy*: Define roles and responsibilities for operations and maintenance. *Objective/Policy*: Identify and apply for funding for proposed Project development, implementation, and maintenance.
Fairbanks North Star Borough	FNSB Regional Comprehensive Plan (2005)	Fairbanks Lateral: Construction = 360 acres Operation = 108 acres	MP 9 to 34.4	The FNSB Zoning Map and Zoning Code are extensions of the Comprehensive Plan land use categories, and are the administrative tools for implementing land use policies and regulations. Pursuant to the Zoning Code, the installation and maintenance of utility lines are permitted uses in the zoning districts.
Denali Borough	Denali Borough Comprehensive Plan (2009)	GCF to MP 540: Construction = 701.9 acres TEWS = 64 acres Operation = 189 acres MP 540 to MP 555: Construction = 449 acres	MP 490.5 to 575.5	Land in the Borough is zoned unrestricted unless otherwise provided for by ordinance. There are no prohibitions on land zoned unrestricted. [Ord. 96-04 § 2.]

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
		TEWS = 29 acres Operation = 57 acres MP 555 to End: Construction = 249 acres TEWS = 29 acres Operation = 78 acres **Denali National Park Route Variation:** Construction = 185 acres Operation = 61 acres		
Matanuska-Susitna Borough	Mat-Su Borough Wide Comprehensive Plan (2005 update)	MP 555 to End: Construction = 1,950 acres TEWS = 235 acres Operation = 585 acres	MP 575.5 to 736.4	The plan states that "[i]n order for the Borough to keep pace with new technologies and globalization of the economy, recommendations should be considered for other modes of transportation such as electrical, communications, and pipelines" (p. 8). The plan includes the following policy for orderly development of multi-modal transportation, including pipelines: Policy T1-4: Develop an effective multi-modal transportation plan that provides recommendations for modes of transportation including surface, air, waterborne, rail, public transit and trails, pipeline, electrical, and communications. Such a plan should strive to better connect the borough's various communities and neighborhoods.
	Trapper Creek Community Council Comprehensive Plan	MP 555 to End: Construction = 304 acres TEWS = 36 acres Operation = 91 acres	MP 645.5 to 673	Plan is under development
	Susitna Community Council Comprehensive Plan (2005)	MP 555 to End: Construction = 231 acres TEWS = 44 acres Operation = 69 acres	MP 674 to 693	The plan does not provide guidance related to utility corridors.
	Willow Area Community Comprehensive Plan (draft September 2009)	MP 555 to End: Construction = 347 acres TEWS = 42 acres Operation = 104 acres	MP 693 to 721.6	The draft plan does not mention utility corridors.
	Big Lake Community Council Area Comprehensive Plan Update (August 2009)	MP 555 to End: Construction = 55 acres TEWS = 10 acres Operation = 16 acres	MP 729.8 to 734.5	Strategy 4 of the plan recommends that utilities be placed underground for future development in the Big Lake Community.
	Point MacKenzie	MP 555 to End:	MP 734.5 to 736.4	The plan contains language relevant to pipeline development through the area,

TABLE 5.9-13 Summary of Applicable Land Use Plans and Documents

Author/Agency	Land Use Plan/Document	ROW Segment(s) Intersecting Plan Boundaries and Acreages Affected	Mileposts	Relationship with the Proposed Action
	Community Council Comprehensive Plan (Draft December 2010)	Construction = 24 acres TEWS = 2 acres Operation = 7 acres		including expressing a need for “expanded utility infrastructure” (p.22) and encouraging “development of efficient energy sources in the community” (p.12). Furthermore, Goal 5 intends to: Encourage the routing of major “linear” infrastructure projects to locate away from existing or planned commercial or residential areas unless doing so will clearly result in unreasonable land use outcomes or conflicts. Limited available public land for development in the Point MacKenzie community will result in a majority of the development occurring along Point MacKenzie Road. Every effort should be made to retain the open nature and natural beauty of this corridor. **Objective 1:** New “linear” projects should locate along existing easements and rights-of-way.

Acreage calculations are based on 100-foot-wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012)

Transportation/Utilities

As described above and as shown in Table 5.9-10, the proposed Project ROW would cross railroads, utilities (including the TAPS), trails, driveways, and local and arterial roads. Potential effects would include disruption to traffic flow and utility service. However, design features of the proposed Project would minimize these effects. For major road crossings, the Applicant proposes to use a boring method that would neither affect the road surface nor impede traffic flow. Arterial roads would be crossed using trenchless methods. For road crossings where the pipeline cannot be installed by boring, a trench would be excavated. In such cases, a temporary bypass or bridge would be built to minimize the effects to traffic flow.

All railroad crossings would be installed by trenchless methods; therefore, there would not be disruptions to railroad service.

TAPS crossings and critical access road crossings would be installed by trenchless methods. Effects from crossing existing foreign pipelines and utility lines would be minimized by boring below the existing pipeline or utility.

Effects to transportation and utilities due to construction of the proposed pipeline are expected to be minor and temporary. Given that the pipeline would be buried, no effects to transportation or utilities due to operation of the proposed pipeline are anticipated. Maintenance of the proposed pipeline in areas of road and utility crossings would result in temporary and minor effects similar to the construction phase.

The Applicant has committed to develop and implement traffic control plans to minimize negative impacts to local businesses during construction as described in Section 5.23, Mitigation.

Section 6(f) of the Land and Water Conservation Fund

The proposed MP 555 to End segment of the proposed Project would cross Denali State Park, which is Section 6(f) parkland, between MP 608.6 and MP 645.8. While a portion of the pipeline would remain within the Alaska DOT ROW when crossing Denali SP, the construction ROW would affect approximately 114 acres and the permanent ROW would affect approximately 45 acres outside of the Alaska DOT ROW. The proposed Project would therefore trigger a 6(f) conversion and would require approval from the NPS for the conversion of lands. In addition, a ROW permit would be required from the ADNR Division of Parks and Outdoor Recreation.

The NPS would consider conversion of public outdoor recreation areas to another use if the following conditions are met:

- Practicable alternatives to the conversion have been evaluated and rejected on a sound basis;
- The property proposed for substitution is of at least fair market value as that of the property to be converted; and
- The property proposed for replacement is of reasonably equivalent usefulness and location for recreational purposes as that being converted.

R.S. 2477 Trails, 17(b) Easements, and Section-Line Easements

As described above and as shown in Tables 5.9-7(a) and (b), the proposed Project would intersect twenty R.S. 2477 ROW and ten 17(b) easements. In addition, the proposed Project would intersect section-line easements (some section-line easements are also R.S. 2477 ROW). The proposed Project would not infringe upon the existing rights attributable to the R.S. 2477 ROW, 17(b) easements, and section-line easements that it would cross.

As described in the ROW permit granted to the applicant by the State (Appendix M), the proposed Project may not obstruct a public access easement or otherwise render it incapable of reasonable use for the purposes for which it was reserved. The proposed Project would therefore not interfere with the use of section-line easements, R.S. 2477, and 17(b) easements. The ROW permit also specifies that before any particular activity requiring any federal, State, or municipal permits or authorizations occurs under the Lease, all required permits and other authorizations for that particular activity must be obtained by the applicant. The applicant would therefore be required to obtain the necessary permits or authorizations prior to constructing any proposed Project features that would intersect with section-line easements, R.S. 2477, and 17(b) easements.

Temporary effects may result during construction, when a small portion of each intersected trail and easement may need to be disturbed during the process of burying the proposed pipeline. Similar temporary effects may occur during maintenance should it be necessary to dig up a portion of pipeline buried within R.S. 2477 ROW, 17(b), and section-line easements. Temporary alternative access across Native-owned land may need to be negotiated with the Native land owner and the Federal agency administering the easement. It may be necessary to acquire alternative legal access prior to blocking 17(b) easements across Native land. The Applicant has proposed a mitigation measure that would retain existing public access routes and uses (Section 5.23, Mitigation). Operation of the proposed Project would not be expected to affect the use and access through the R.S. 2477 ROW, 17(b), and section-line easements.

Forest Land

Tables 5.9-8 and 5.9-9 show the acreage of forest types that would be cleared for construction and operation of each segment of the proposed Project ROW. Table 5.9-14 shows the acreages of forest land that would be affected by the proposed Project within the federal and state planning areas intersected by the ROW. After proposed Project construction, those forested areas outside of the proposed permanent Project facilities (i.e., permanent ROW, new access roads, and aboveground facility footprints) would be allowed to revert to pre-Project conditions. Forest land would not be restored within the permanent proposed Project footprint; therefore, there would be a long-term conversion of forest land use in these areas. The volume of commercial timber within areas that would be cleared for the proposed Project ROW has not been quantified by a timber survey.

The 2006 Alaska Forest Resources and Practices Act (FRPA, AS 41.17) governs how timber harvesting, reforestation, and timber access occur on state, private, and municipal land. Forest management standards on federal land must also meet or exceed the standards for state land established by the Act (ADNR 2011a). Section 41.17.083 of the FRPA provides guidance regarding the clearing of forest land for non-timber purposes:

> *A state agency, municipality, or public utility shall determine whether the timber to be removed has significant salvage value before approving or conducting clearing of forest land for purposes other than timber harvest. If the timber has significant salvage value, the agency or utility shall salvage the timber as part of the clearing process (§10 ch 34 SLA 1990).*

The FRPA provisions for timber salvage within lands that would be cleared for the pipeline ROW would assure that timber resources affected by the proposed Project would be properly utilized. The Applicant would conduct a desktop analysis, supplemented with surveys, of merchantable timber in the proposed Project area in 2011. The applicant would determine the appropriate evaluation methods in coordination with regulatory agencies during the design and construction phase of the proposed Project.

Agriculture

Effects to agricultural land would be minimal, with only 0.1 percent of the construction area affected by the proposed Project ROW consisting of agricultural land (see Table 5.9-4). As allowable land uses generally permitted within the permanent ROW would include agriculture, including the use of farming equipment and the cultivation of row crops, and pastureland, impacts to these agricultural lands would generally be limited to the duration of proposed Project construction.

TABLE 5.9-14 Timber Resources in Federal and State Planning Areas Affected by the Construction ROW (Acres) and TEWS

Land Use Plan	GCF to MP 540	TEW GCF to MP 540	Fairbanks Lateral	MP 540 to MP 555	TEW MP 540 to MP 555	MP 555 to End	TEW MP 555 to End	Proposed Action Total	Yukon River Crossing Options	Denali National Park Route Variation
BLM										
Utility Corridor RMP	767.3	126	0	0	0	0	0	893.3	0	0
Central Yukon RMP	11.4	1.8	0	0	0	0	0	13.2	0.1	0
East Alaska RMP	0	0	0	0	0	1.7	0.4	2.1	0	0
Dalton Highway Recreation Area Management Plan	800.2	139.8	0	0	0	0	0	940	0	0
NPS										
Denali NPP Consolidated General Management Plan	0		0	0		0		0	0	29.8
ADNR										
State Lands not Covered by an Area Plan	1,155.9		0	0	0	0	0	1,155.9	6.8	0
North Slope Site Specific Plan	5.7	1.2	0	0	0	0	0	6.90	0	0
Susitna Area Plan	0	0	0	0	0	937.5	114	1,051.5	0	0
Tanana Basin Area Plan	1,111.4	106.4	153.2	305.5	22.2	69.1	5.5	1,773.3	0	70.7
Southeast Susitna Area Plan	0	0	0	0	0	418.9	69.1	488	0	0
Susitna-Matanuska Area Plan	0	0	0	0	0	430.9	57	487.9	0	0
Willow Creek State Recreation Area Master Plan	0	0	0	0	0	15.7	1.7	17.4	0	0
Tanana Valley State Forest Management Plan	166.4	9.2	9	0	0	0	0	184.6	0	0
Susitna Basin Recreation Rivers Management Plan	0	0	0	0	0	9.5	1.4	10.9	0	0
Denali State Park Management Plan	0	0	0	0	0	374	29.1	403.1	0	0
Dalton Highway Master Plan	1,300.9	184.2	0	0	0	0	0	1,485.1	0	0
ADF&G										
Minto Flats State Game Refuge Management Plan	230.5	22.9	0	0	0	0	0	253.4	0	0

Source: USGS 2001 National Landcover Dataset (Evergreen Forest, Mixed Forest, and Deciduous Forest). Acreage calculations are based on 100-foot-wide Temporary Construction Easement and Temporary Extra Workspaces (AGDC 2012)

Note: The areas covered by some of the land use plans overlap.

The State of Alaska does not contain prime farmland, prime forest land, or prime rangeland. In addition, no unique farmlands or farmlands of statewide importance have been designated in Alaska. Important farmland, prime forest land, and prime rangeland receive protection from the Farmland Protection Policy Act (FPPA) and United States Department of Agriculture (USDA) Departmental Regulation No. 9500-3, Land Use Policy. The USDA regulation, 7 C.F.R. Part 658, implements the FPPA. As shown in Table 5.9-11, the construction and permanent ROWs for the GCF to MP 540 segment, Fairbanks Lateral, and MP 555 to End segment would affect soils designated as Farmlands of Local Importance by the Fairbanks SWCD and the Matanuska-Susitna Borough.

Developed Areas

As described above and as shown in Tables 5.9-3 through 5.9-5(b), the proposed Project would affect developed areas. A survey has not been conducted to determine the location and number of structures, residential or otherwise, within close proximity to the ROW and aboveground facilities. However, the density of development in the proximity of the ROW is inferred by the class locations assigned to the various sections of the proposed pipeline (see Section 5.18, Reliability and Safety).

The proposed Project has the potential to affect developed land by exposing residences or commercial/industrial buildings located near the proposed Project ROW and aboveground facilities to dust and noise primarily during proposed Project construction. Section 5.16 (Air Quality) and 5.17 (Noise) discuss the effects related to dust and noise, respectively. Furthermore, in some areas the proposed Project would result in the removal of trees within the proposed ROW that currently provide a visual buffer between private properties and the Parks Highway.

In addition to noise, dust, and visual effects, the proposed Project has the potential to affect developed areas by hindering short or long-term land uses on lands within or in near proximity to the ROW. Some current land uses would be converted to long-term utility use for the life of the proposed Project. The long-term conversion would put permanent constraints on development of private land. To facilitate pipeline integrity management and safety inspection activities, it is assumed that the Applicant would not permit permanent structures that are not easily removed to remain on the permanent ROW. No dwellings could be placed within the permanent ROW (53 feet on federal lands ROW and 30 feet on state/private lands ROW), which would be maintained in an open condition for the life of the pipeline.

5.9.2.3 Denali National Park Route Variation

Effects to Land Use Planning

The Denali National Park Route Variation would intersect lands managed according to the Denali NPP Consolidated General Management Plan, the Tanana Basin Area Plan, and DB Comprehensive Plan. Table 5.9-13 above describes the consistency of the proposed Project with existing land use and management plans and shows the acreage affected within each planning boundary.

Transportation/Utilities

As shown in Table 5.9-10, the Denali National Park Route Variation would intersect the railroad ROW twice. This segment would not cross roads, trails/driveways, utilities, or the TAPS. All railroad crossings would be installed by trenchless methods; therefore, no disruption to railroad service would occur.

R.S. 2477 ROW, 17(b) Easements, and Section-Line Easements

The Denali National Park Route Variation would not intersect R.S. 2477 ROW and 17(b) easements. Some section-line easements would be intersected by the Denali National Park Route Variation. As with the proposed Project, the Denali National Park Route Variation would not interfere with the use of section-line easements, R.S. 2477 ROW, and 17(b) easements.

Denali National Park and Preserve

The Denali National Park Route Variation would intersect the boundary of the Denali NPP. As discussed in Section 4, Alternatives currently, Federal laws do not allow construction of this route variation within Denali NPP (see further discussion of applicable federal authorities in Section 1.2.6.3 ANILCA TITLE XI). Federal legislation that would allow the route variation has been introduced by the Alaska delegation, and is currently being considered by the U.S. Congress. If authorized by Congress, the NPS would have authority to authorize a ROW for the alternate route or mode which would result in the least environmentally damaging practicable alternative (LEDPA) upon the area.

Therefore, the AGDC would work with NPS to adjust and refine the proposed route through Nenana Canyon to assure that the route or mode which would result in the LEDPA upon the area would be constructed.

Forest Land

The Denali National Park Route Variation would affect evergreen forest and mixed forest (see Tables 5.9-8 and 5.9-9). The volume of commercial timber within areas that would be cleared for the proposed Project ROW has not been quantified by a timber survey. As shown in Tables 5.9-13 and 5.9-14, the Denali National Park Route Variation would result in forest land being cleared from lands managed according to the Denali NPP Consolidated General

Management Plan and the Tanana Basin Area Plan. It should be noted that forest land that would be cleared in the area managed by the Denali NPP Consolidated General Management Plan is located within the Alaska DOT&PF ROW.

As for the proposed Project, the FRPA provisions for timber salvage within lands that would be cleared for the Denali National Park Route Variation ROW would assure that timber resources affected by the proposed Project are properly utilized.

Agriculture

The Denali National Park Route Variation would neither affect agricultural lands nor farmlands of local importance.

Developed Areas

As described above and as shown in Tables 5.9-3 through 5.9-5(a), the Denali National Park Route Variation would affect developed areas. The same types of effects would occur as for the proposed Project.

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5.9.3.1 Personal Communications

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5.10 RECREATION

This section describes existing recreation resources and activities in the proposed Project area, and assesses the potential recreation-related impacts that may result from development of the proposed Project or the alternatives. Section 5.10.1 describes the affected environment, which includes an overview of the related regulatory setting in the proposed Project area (Section 5.10.1.1, Regulatory Environment). The impact analysis presented in Section 5.10.2, Environmental Consequences, focuses on the extent to which pipeline construction and operations are expected to affect recreation resources and activities and associated visitation and user patterns. The impact analysis is based on the location, timing and other relevant characteristics of construction and operations activities which may affect visitors and local residents engaging in recreation activities in the proposed Project area. Potential effects on recreational resources consider mitigation measures incorporated into the proposed Project to minimize impacts (Section 5.23.10).

5.10.1 Affected Environment

There are many recreation opportunities available throughout the State of Alaska. This is primarily attributed to the state's expansive land area, water resources, and abundant natural features. These recreation resources represent the foundation of the tourism industry in the state and help support the tourism-oriented economy of many regions, including areas affected by the proposed Project. This section describes the recreation environment in the proposed Project area, focusing on recreational areas and facilities and typical recreation activities that characterize the area surrounding the pipeline routes considered in this Environmental Impact Statement (EIS), as well as management and regulatory considerations related to recreation. This information is intended to provide context to anticipated short- and long-term impacts on recreation presented in Section 5.10.2, including the potential effects on recreational access and quality of the recreation experience during proposed Project construction and operations.

5.10.1.1 Regulatory Environment

The regulatory environment associated with recreation resources in the proposed Project area is based primarily on implementing regulations under jurisdiction of the various public land managers in the proposed Project area, including the Bureau of Land Management (BLM), National Park Service (NPS), United States Fish and Wildlife Service (USFWS), Alaska Department of Natural Resources (ADNR), and the Alaska Department of Fish and Game (ADF&G). These public agencies implement applicable regulations related to recreation on the federal and state lands that comprise most of the land base in Alaska. These regulations include:

- 43 CFR Part 2930 – Permits for Recreation on Public Lands (Previously 43 CFR 8370);
- Federal Land Policy and Management Act (FLPMA) – 43 CFR 8360 – Visitor Services;

- Land and Water Conservation Fund Act of 1965 – Planning, Acquisition, and Development of Recreation Lands;
- Office of Management and Budget Circular A-25 of 1993, revised – User Charges;
- Title 36 CFR, subpart 71 – Recreation Fees;
- Alaska Administrative Code (AAC), Title 11, Part 2 – Parks, Recreation, and Public Use;
- AAC, Title 11, Part 6 – Lands; and
- Alaska Statutes, Title 16, Chapter 16.05 – Fish and Game Code.

As further identified by the NPS during proposed Project scoping, Denali State Park (SP) and Nancy Lakes State Recreation Area (SRA), are considered 6(f) properties under the Land and Water Conservation Fund (LWCF) Act (16 U.S.C. 4601-4 *et seq.*). Section 6(f) of the LWCF Act requires that no property acquired or developed with LWCF assistance shall be converted to a use other than public outdoor recreation uses without the prior approval of the U.S. Secretary of the Interior. Moreover, if the Secretary of Interior approves a conversion, other recreation properties of at least equal fair market value and reasonably equivalent recreational usefulness and location must be substituted pursuant to Section 6(f)(3) provisions. This ensures that the area will be committed to outdoor recreation in perpetuity. The proposed Project would cross Denali SP, which may trigger a Section 6(f) review, but would not cross the Nancy Lakes SRA.

From a planning perspective, recreation is addressed at the state level as part of the Alaska Statewide Comprehensive Outdoor Recreation Plan (SCORP) process, which is administered by the ADNR. In addition, recreation resources throughout Alaska are covered in most of the management plans implemented by public land managers. The management agencies and management plans applicable to the proposed Project area are described in Sections 5.10.1.3 and 5.10.1.4 and provide the basis for regulating recreational activities. Additional information on applicable management plans is presented in Section 5.9, Land Use.

In addition, many of the recreation areas discussed in this section were established as part of the Alaska National Interest Lands Conservation Act (ANILCA) of 1980, which placed large parts of Alaska in the nation's conservation, wilderness, and recreation systems, as well as wild and scenic rivers, forests, wildlife refuges, and parks.

Section-Line Easements, Revised Statute 2477 Rights-of-Way, and Section 17(b) Easements

The proposed Project would intersect section-line easements, which are public rights-of-way (ROW) 33, 50, 66, 83, or 100 feet wide that are located along a section line of the rectangular survey system. Some section-line easements are also Revised Statute (R.S.) 2477 ROW. R.S. 2477 ROW are trails that have been established under Alaska Revised Statute 2477. Essentially, R.S. 2477 trails have been established within the ROW associated with the construction of roads, trails, or highways over public lands, which have not been reserved for public uses. These trails provide access to many rural destinations, and are primarily used by snow-machines, dogsled teams, and four-wheel all-terrain vehicles. For more information on R.S. 2477, refer to Section 5.9, Land Use.

In addition to section-line easements and R.S. 2477 trails, the proposed Project would intersect Section 17(b) easements. Section 17(b) easements are rights reserved to the United States in the form of 60-foot-wide roads and 25- and 50-foot-wide trails granting access to public lands and major waterways across Federal lands property that were transferred to Native corporations. The easement does not grant access to the private lands it crosses. There may be overlap between R.S. 2477 trails and Section 17(b) easements.

Section-line easements, RS 2477 trails and Section 17(b) easements preserve access to both private and public lands for a variety of purposes, including recreation. Access resulting from section-line easements, R.S. 2477 trails, and Section 17(b) easements provide a range of recreation opportunities, primarily off-highway vehicle (OHV) use. Because these trails facilitate access to remote parts of the state, they also support other activities, such as fishing and hunting. The specific types of recreation supported on section-line easements, R.S. 2477 trails, and Section 17(b) trails transected by the proposed Project pipeline are not known. As described in the ROW permit granted to the applicant by the State (Appendix M), the proposed Project may not obstruct a public access easement or otherwise render it incapable of reasonable use for the purposes for which it was reserved. The proposed Project would therefore not interfere with the use of section-line easements, R.S. 2477, and 17(b) easements.

5.10.1.2 Overview of Recreation and Tourism in the Proposed Project Area

Recreation opportunities in Alaska are generally available on most lands in public ownership, as well as large private land holdings and other types of open space and water bodies. There are approximately 322 million acres of public land in Alaska, most of which is available for recreation (SCORP 2009). However, public access for recreation can be difficult due to constraints associated with land ownership, geography and distance, topography, and lack of transportation infrastructure. Consequently, many recreation areas in Alaska are accessible only by plane or boat.

Outdoor recreation in Alaska is generally organized into two broad categories: wildland recreation and community-based recreation. Wildland recreation is typically resource oriented (e.g., fishing and hunting), while community-based recreation is centered on family or school-oriented activities in Alaska’s more urban areas. The major seasons for wildland recreation tend to center around salmon fishing in the spring and early summer and big game and waterfowl hunting in the fall. Community recreation generally serves the recreational needs of local residents on a year-round basis.

The proposed Project would primarily affect wildland recreation opportunities along the proposed pipeline routes; therefore, wildland recreation is the focus of this section. In total, approximately 168 million acres, or 46 percent of Alaska, is managed for wildland recreation, including areas within national parks, state parks, and national forests (SCORP 2009). Recreation facilities, such as campgrounds, trails, trailheads, cabins and boat launches, are found in some areas managed for wildland recreation. However, with such an expansive land base, these types of facilities are limited in many recreation areas, thereby limiting the types of developed recreational opportunities available to the public. In addition, an extensive system of rivers and lakes throughout the state support a range of recreation uses, including floating, boating, and fishing.

Wildland recreation serves both residents and non-resident visitors, with the latter constituting the basis for a strong tourism industry in the state. Recreation resources is one of the primary elements driving tourism, the second largest private sector employer in Alaska. Tourism generally peaks during the summer season. In the summer of 2008, more than 1.7 million people visited Alaska, and visitor spending during the summer of 2007 was nearly $1.6 billion (SCORP 2009).

Important recreation resources and tourism opportunities are located on public lands and within water bodies in proximity to the proposed pipeline route, which closely parallels the developed road system providing access to these areas. In addition, the proposed Project route and alternatives are located near Fairbanks and Anchorage, both of which often serve as trip anchor locations for recreational visitors to the region.

5.10.1.3 Recreation Management

Recreation management along the proposed Project route is primarily the responsibility of federal and state land management agencies. Generally, management of recreation resources on public lands is addressed under comprehensive land management plans implemented by these entities (for more information on these plans, refer to Section 5.9, Land Use). The management focus of these agencies varies and is often multi-faceted, requiring balancing recreation objectives with other resource considerations. The following is a list of public agencies with land management responsibilities in the proposed Project area along with an overview of their recreation management objectives. Specific recreation areas and facilities and their respective management plans are discussed in more detail in Section 5.10.1.4.

Bureau of Land Management (BLM)

The BLM in Alaska has management responsibility on vast amounts of public land. There are two BLM district offices in Alaska: the Fairbanks District Office covering the northern portion of the state and the Anchorage District Office covering southern Alaska. As outlined in regional resource management plans (RMPs), the BLM manages public lands in Alaska for multiple uses, including recreation. Applicable RMPs in the proposed Project area include Utility Corridor RMP, Central Yukon RMP, and East Alaska RMP. Recreation management on BLM lands covers an array of activities and facilities, including trails and waterways. In the proposed Project area, the BLM also is the administrator for the Iditarod National Historic Trail and has management responsibility for the White Mountains National Recreation Area (NRA) and various public lands and facilities providing recreation opportunities in proximity to the Dalton and Parks highways. The *Recreation Management Plan for the Dalton Highway Recreation Management Area* (BLM 1991) guides BLM management of numerous recreation facilities located along the Dalton Highway corridor. Management of recreation use along the Dalton Highway corridor is also informed by the *Benefits-Based Management Study for the Dalton, Taylor, and Denali Highways* (Stegmann, et. al. 2008).

National Park Service (NPS)

The NPS manages a total of 17 units in Alaska in an effort to protect representative natural, cultural, and historic features across the state. Lands managed by the NPS expanded substantially with ANILCA (1980), which established 11 new management units, including the Alagnak National Wild River, and expanded three existing NPS units, including Denali National Park and Preserve (NPP). Recreation represents an important focus of NPS management. In 2009, there were approximately 2.3 million recreational visitors to NPS units in the Alaska region (NPS 2009a). Park units located in the proposed Project area include Gates of the Arctic NPP and Denali NPP. Tourism plays a large role in managing NPS units, particularly Denali NPP, and provides substantial economic benefits to local communities and the State of Alaska.

U.S. Fish & Wildlife Service (USFWS)

The USFWS plays an important role in recreation management in Alaska, particularly based on its focus on species and habitat conservation in the context of fishing and hunting. Furthermore, the USFWS manages a number of national wildlife refuges (NWR) in the proposed Project area that provide wildlife-based recreational opportunities, including the Arctic NWR (ANWR), Yukon Flats NWR and Kanuti NWR. From a management perspective, Section 304(g) of the ANILCA requires the preparation of a comprehensive conservation plan (CCP) for each unit of the NWR system established or enlarged by the Act. These plans designate areas within a refuge according to their respective resources and values, and establish opportunities for fish and wildlife-oriented recreation.

Alaska Department of Fish and Game (ADF&G)

The ADF&G implements the management of sport fisheries and hunting and wildlife resources at the state level. The Division of Sport Fish focuses on recreational and personal use fisheries, valued at more than $500 million annually (ADF&G 2011). The Division of Wildlife Conservation focuses its management efforts on wildlife populations and habitats and is responsible for managing the state game refuge system. Refuges and other conservation areas located in the proposed Project area include: the Minto Flats State Game Refuge, Susitna Flats State Game Refuge, Goose Bay State Game Refuge, and Palmer Hay Flats State Game Refuge, Creamer's Field Migratory Waterfowl Refuge, and Willow Mountain Critical Habitat Area.

Alaska Department of Natural Resources (ADNR), Division of Parks and Outdoor Recreation

ADNR Division of Parks and Outdoor Recreation manages the Alaska State Parks system and other recreation features throughout the state. With a focus on recreation, the ADNR plays a key role in providing recreation opportunities to local residents and visitors. The ADNR has developed management plans for each of its larger park units which outline future recreational developments as well as general recreational goals and policies. It also implements the Alaska Recreational Trails Plan, which established an integrated system of trails across the state. Visitation data on individual units are not readily available. However, the National Association of State Park Directors (2010) has compiled aggregate data on the 139 management units the ADNR oversees, including 48 parks and 80 recreation areas, covering nearly 3.4 million acres. In total, the Alaska State Parks system attracted a total of 5.2 million visitors in 2008-2009, which primarily consisted of day users (4.5 million visitors) and overnight visitors (roughly 715,000 annually) served by nearly 2,600 campsites located throughout the state park system. Many of the recreation features in the proposed Project area under public ownership are managed by the ADNR, including: Denali SP, Montana Creek SRA, Big Lake North State Recreation Site, Rocky Lake State Recreation Site, Big Lake South State Recreation Site, Nancy Lake SRA, Kroto & Moose Creek Recreation River, Goldstream Public Use Area, Willow Creek SRA, Little Susitna Recreation River, Alexander Creek Recreation River, and Talkeetna Recreation River. ADNR also manages the Iditarod National Historic Trail on state land, which includes the portion of the trail that is crossed by the proposed pipeline.

Alaska Department of Natural Resources (ADNR), Division of Forestry

The ADNR Division of Forestry has management responsibility for three state forests, which cover about two percent of state-owned land. The primary management purpose in state forests is timber management, namely the production and utilization of timber resources. Recreation represents one of several ancillary beneficial uses on state forest land. The Tanana Valley State Forest (SF) is located in the proposed Project area.

Alaska Department of Natural Resources (ADNR), Division of Mining, Land, and Water

The ADNR Division of Mining, Land, and Water manages other state lands for multiple purposes. For those lands owned by the state but not covered by a land management plan, the ADNR coordinates with the public to identify important land resources and determine how these lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible, multiple uses are allowed on these lands.

5.10.1.4 Recreation Facilities and Activities

Wildland recreation in Alaska includes a wide spectrum of recreation activities, including but not limited to: fishing, hunting, camping, hiking and trail use, horseback riding, mountain biking, snow-skiing, snowshoeing, snowmobiling, OHV use, wildlife viewing and bird watching, recreational mining (e.g., gold panning), mountaineering, whitewater rafting, spelunking, dog mushing, ocean kayaking, and power boating. The state's road system plays an important role in recreation and tourism by facilitating access to recreational areas and facilities, and public roadways also provide opportunities for viewing wildlife, general sightseeing, scenic driving, and cultural and historic tours. Many of the outdoor activities referenced above commonly occur at the recreational areas and facilities located in proximity to or directly crossed by the proposed Project route and alternatives[1]. These recreation features are described in greater detail below and organized by pipeline segment, including visitation data where available. Table 5.10-1 summarizes recreation features along the pipeline routes. Recreation areas are shown in Figures 5.10-1 and 5.10-2.

[1] For this analysis, all recreation features within a 20 mile buffer of the proposed pipeline routes were considered.

TABLE 5.10-1 Distance between Proposed Project Facilities and Recreation Features (miles)

Recreation Feature	Nearest Milepost	Project Facility										
		Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Alexander Creek Recreation River	727	11.7	216.5	139.5	595.1	216.4	216.4	16.7	14.8	N/A	16.9	19.4
Arctic NWR	151	0.2	167.0	252.4	56.6	48.3	183.2	416.9	0.7	N/A	2.7	2.4
Big Lake North State Recreation Site	726	10.1	224.8	142.8	608.3	224.7	224.7	11.1	13.4	N/A	11.1	1.4
Big Lake South State Recreation Site	727	10.5	225.3	143.2	608.9	225.2	225.2	11.2	14.4	N/A	11.2	1.2
Creamer's Field Migratory Waterfowl Refuge	448	26.5	2.5	85.0	376.5	30.6	30.5	248.8	29.7	N/A	1.1	4.6
Denali NPP	538	0.1	54.1	0.0	437.8	54.0	53.9	79.9	0.0	N/A	0.8	0.0
Denali SP	609 – 646	0.0	127.3	48.8	510.4	127.2	127.2	77.9	0.0	N/A	0.7	0.0
East Fork Chulitna River Campground	592	0.1	112.8	33.3	495.7	112.7	112.6	121.3	4.3	N/A	14.1	0.3
Gates of the Arctic NPP	193	1.1	164.1	235.4	132.5	2.1	168.1	388.8	1.2	N/A	2.0	1.6
Globe Creek Camp	419	15.6	24.4	109.0	351.9	41.0	41.0	273.5	15.8	N/A	20.6	1.5
Goldstream Public Use Area	443	22.7	0.1	84.8	372.0	27.3	27.2	249.0	26.1	N/A	4.1	2.7
Goose Bay State Game Refuge	736	2.8	233.3	151.3	616.7	233.2	233.2	2.9	17.2	N/A	2.8	0.3

TABLE 5.10-1 Distance between Proposed Project Facilities and Recreation Features (miles)

Recreation Feature	Nearest Milepost	Project Facility										
		Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Grapefruit Rocks Recreation Area	417	15.4	26.4	110.9	346.5	42.7	42.7	275.3	15.4	N/A	19.3	2.1
Iditarod Trail	733	0.0	196.9	130.7	428.8	196.9	196.9	1.9	10.4	N/A	1.9	0.2
Kanuti NWR	304	9.7	112.8	174.2	248.0	12.5	112.9	320.0	9.9	N/A	12.8	9.1
Kroto & Moose Creek Recreation River	713	3.2	165.8	89.7	545.6	165.7	165.6	19.2	4.0	N/A	6.8	0.0
Little Susitna Recreation River	730 - 731	0.0	211.1	127.8	595.8	211.0	210.9	3.3	5.6	N/A	3.5	0.1
Minto Flats State Game Refuge	418 – 426 433 – 456	0.0	0.7	61.7	347.5	0.7	0.7	220.0	0.0	N/A	0.7	0.3
Montana Creek SRA	682	0.1	187.9	107.8	570.7	187.8	187.8	46.8	2.7	N/A	3.9	0.5
Nancy Lake SRA	716	0.2	214.6	133.2	597.5	214.5	214.4	10.2	0.4	N/A	2.6	0.2
Nancy Lake State Recreation Site	707	4.7	215.2	133.9	598.3	215.1	215.1	18.8	6.6	N/A	3.4	0.4
Palmer Hay Flats State Game Refuge	736	18.2	222.1	138.8	606.8	222.0	221.9	18.3	23.5	N/A	18.2	0.0
Prudhoe Bay	1	0.9	372.9	454.9	0.5	198.2	384.3	616.3	17.1	N/A	3.3	9.1
Rocky Lake State Recreation Site	732	11.3	223.8	141.7	607.7	223.7	223.7	12.4	13.8	N/A	12.4	2.6

TABLE 5.10-1 Distance between Proposed Project Facilities and Recreation Features (miles)

Recreation Feature	Nearest Milepost	Project Facility										
		Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Susitna Flats State Game Refuge	734	0.2	231.5	150.2	614.2	231.4	231.3	1.6	13.0	N/A	1.9	2.6
Talkeetna Recreation River	662	3.2	153.2	70.2	537.8	153.1	153.0	62.0	4.7	N/A	10.2	0.3
Tanana Valley SF	425 – 433 450 – 458 469	0.0	0.0	56.9	337.5	0.4	0.5	213.9	0.7	N/A	0.3	0.0
White Mountains NRA	410	17.6	19.7	105.0	308.0	38.2	38.2	269.5	19.0	N/A	20.0	1.2
Willow Creek SRA	708 – 709	0.0	209.7	128.9	592.2	209.6	209.6	22.9	6.8	N/A	1.4	0.0
Willow Mountain Critical Habitat Area	693	8.8	193.4	111.2	577.3	193.3	193.3	27.7	9.8	N/A	9.3	8.7
Yukon Flats NWR	369	1.7	61.3	142.1	217.4	21.4	72.2	303.0	5.4	N/A	4.4	1.3

Note: Distances determined though ArcGIS desktop spatial analysis.
Sources: AGDC, ESRI, Alaska State Geo-Spatial Data Clearinghouse, & Alaska Division of Parks & Outdoor Recreation.

TABLE 5.10-2 Distance between Proposed Project Facilities and BLM-Administered Recreational Sites along the Dalton Highway (miles)

Recreation Feature	Project Facility											
	Nearest Milepost	Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Highway Miles Sign	404	0.4	43.0	122.0	333.6	51.4	51.4	285.1	12.3	N/A	1.7	1.0
Black Gold brings Coldfoot to Life	246	0.1	171.7	246.4	215.9	18.8	177.5	403.6	1.5	N/A	0.4	0.3
Coldfoot Reborn...Again	246	0.0	171.6	246.3	215.9	18.8	177.4	403.5	1.5	N/A	0.3	0.2
Structure	246	0.1	171.6	246.4	215.9	18.8	177.5	403.6	1.5	N/A	0.3	0.3
Coldfoot - Another Ghost Town	246	0.1	171.6	246.3	215.9	18.8	177.5	403.6	1.5	N/A	0.3	0.3
Stories Lost in Time	246	0.1	171.6	246.3	215.9	18.8	177.5	403.6	1.5	N/A	0.3	0.3
Coldfoot Cemetary	246	0.1	171.6	246.3	215.9	18.8	177.5	403.6	1.5	N/A	0.3	0.3
Arctic Interagency Visitor Center	246	0.1	171.6	246.3	216.0	18.9	177.4	403.5	1.6	N/A	0.4	0.3
Ron Dettmers Plaque	246	0.1	171.6	246.3	216.0	18.9	177.4	403.5	1.6	N/A	0.4	0.3
Kiosk	246	0.1	171.6	246.3	216.0	19.0	177.4	403.5	1.6	N/A	0.4	0.3
Coldfoot Map	246	0.1	171.6	246.3	216.0	19.0	177.4	403.5	1.6	N/A	0.4	0.3
The Dalton Highway Map	246	0.1	171.6	246.3	216.0	19.0	177.4	403.5	1.6	N/A	0.4	0.3
Mountains on the Move	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
Forever Wild and Free	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
The Buzz and Flutter of Arctic Summers	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
Survival Skills	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8

TABLE 5.10-2 Distance between Proposed Project Facilities and BLM-Administered Recreational Sites along the Dalton Highway (miles)

Recreation Feature	Project Facility											
	Nearest Milepost	Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Reading Galbraith's Past	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
Galbraith Lake Map	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
The Dalton Highway Map	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
Kiosk	148	2.2	247.4	327.1	130.8	67.1	257.0	487.0	2.6	N/A	1.7	1.8
Galbraith Lake Campground	148	2.2	247.4	327.1	130.8	67.0	256.9	487.0	2.6	N/A	1.7	1.8
Farthest North Spruce Tree	184	0.0[a]	219.7	298.3	160.4	37.5	228.3	457.7	8.6	N/A	3.8	4.8
... and the Forest Ends	184	0.0[a]	219.7	298.4	160.3	37.6	228.4	457.8	8.7	N/A	3.6	4.6
Where the Tundra Begins	184	0.0[a]	219.7	298.4	160.3	37.6	228.4	457.8	8.7	N/A	3.6	4.6
Kiosk	242	0.2	175.4	250.5	211.6	14.8	181.5	407.8	2.9	N/A	4.6	0.6
Welcome to Marion Creek Campground!	MP 242	0.2	175.4	250.5	211.6	14.8	181.5	407.8	2.9	N/A	4.6	0.6
Camper's Information	MP 242	0.2	175.4	250.5	211.6	14.8	181.5	407.8	2.9	N/A	4.6	0.6
Kiosk, Welcome to Marion Creek Campground!, Camper's Information	242	0.2	175.4	250.5	211.6	14.8	181.5	407.8	2.9	N/A	4.6	0.6
Log Cabin	246	0.0[a]	171.6	246.4	215.8	18.7	177.5	403.6	1.4	N/A	0.3	0.3
Grayling Lake - 3,000 Years of Use	271	0.1	154.7	227.0	237.5	13.2	159.0	382.8	7.5	N/A	11.0	2.2

TABLE 5.10-2 Distance between Proposed Project Facilities and BLM-Administered Recreational Sites along the Dalton Highway (miles)

Recreation Feature	Project Facility											
	Nearest Milepost	Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Fish Migrations	277	0.3	151.9	223.0	242.8	7.4	155.5	378.2	13.0	N/A	5.2	0.9
Gobblers Knob	289	0.7	145.8	214.9	252.9	3.1	148.2	368.9	14.8	N/A	5.3	0.1
The Road North	289	0.7	145.8	214.9	252.9	3.1	148.2	368.9	14.8	N/A	5.3	0.1
Overlook deck	289	0.7	145.8	214.9	252.9	3.1	148.2	368.9	14.8	N/A	5.3	0.1
Arctic Circle Campground	303	1.8	136.3	203.1	266.3	16.5	137.4	356.0	2.5	N/A	10.1	1.8
Fall - Before the Light Goes Out	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Summer - Life in a Hurry	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Spring - A Leap Into Life	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Winter - At the Heart of Darkness	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Overlook deck	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Arctic Circle	303	2.3	136.5	203.0	266.6	16.8	137.4	355.9	2.8	N/A	10.3	2.3
Arctic Circle BLM	303	2.3	136.4	203.0	266.7	16.9	137.4	355.8	2.8	N/A	10.2	2.3
A Rock... and a Hard Place	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.6
Baker's Delight	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.6
The Birth of a River	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.5
Lifeblood of a Wildlife Refuge	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.5
Above the Spruce	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.5
Overlook	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.5

TABLE 5.10-2 Distance between Proposed Project Facilities and BLM-Administered Recreational Sites along the Dalton Highway (miles)

Recreation Feature	Project Facility											
	Nearest Milepost	Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Scrambling for Eggs	319	0.1	119.8	187.3	278.3	30.5	121.0	341.8	4.1	N/A	6.5	6.5
A Head Start Program	319	0.1	119.8	187.3	278.3	30.5	121.0	341.8	4.1	N/A	6.5	6.6
A Firm Foundation	319	0.2	119.8	187.3	278.3	30.5	121.0	341.8	4.1	N/A	6.5	6.6
Leaves of Fire	319	0.2	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.6
Hide and Seek	319	0.2	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.6
Don't Squish My Lunch	319	0.1	119.8	187.3	278.3	30.5	121.0	341.7	4.1	N/A	6.5	6.6
Suited to a Season	319	0.1	119.8	187.2	278.3	30.6	121.0	341.7	4.0	N/A	6.5	6.6
Food to Fly On	319	0.1	119.7	187.2	278.3	30.6	120.9	341.7	4.0	N/A	6.6	6.6
Eat and Run	319	0.1	119.7	187.2	278.3	30.6	120.9	341.7	4.0	N/A	6.6	6.6
Tea to Go	319	0.1	119.7	187.2	278.4	30.6	120.9	341.7	4.0	N/A	6.6	6.6
Welcome to Finger Mountain	319	0.1	119.7	187.2	278.4	30.6	120.9	341.7	4.0	N/A	6.6	6.6
Overlook deck	331	0.6	108.0	175.7	287.8	42.0	109.2	331.1	7.8	N/A	18.3	0.1
5 MI Campground	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.7	N/A	1.7	1.6
Alaska on Fire	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.8	N/A	1.6	1.6
The Dalton Highway Map	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.8	N/A	1.6	1.6
Life on the Line	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.8	N/A	1.6	1.6
Where are all the Animals?	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.8	N/A	1.6	1.6
Kiosk	357	0.2	84.6	153.5	306.2	64.9	86.0	311.1	5.8	N/A	1.6	1.6
Kiosk	361	0.5	80.7	150.4	308.6	68.4	82.5	308.6	2.1	N/A	5.5	0.6

TABLE 5.10-2 Distance between Proposed Project Facilities and BLM-Administered Recreational Sites along the Dalton Highway (miles)

Recreation Feature	Project Facility											
	Nearest Milepost	Mainline	Fairbanks Lateral	Denali National Park Route Variation	Gas Conditioning Facility (GCF)	Compressor Stations	Straddle and Off-Take Facility	Cook Inlet NGLEP Facility	Mainline Valves	O&M Buildings	Camp Laydown Locations	Material Sites
Watery Highways	361	0.8	80.4	150.2	308.7	68.6	82.2	308.4	1.9	N/A	5.8	0.4
Athabascans - People of the Boreal Forest	361	0.8	80.4	150.2	308.7	68.6	82.2	308.4	1.9	N/A	5.8	0.4
Overlook deck	361	0.8	80.4	150.2	308.7	68.6	82.2	308.4	1.9	N/A	5.8	0.4
The Mighty Yukon	361	0.7	80.5	150.2	308.7	68.6	82.2	308.4	2.0	N/A	5.8	0.4
Overlook deck	361	0.7	80.5	150.2	308.7	68.6	82.2	308.4	2.0	N/A	5.8	0.4
Dalton Highway	361	0.8	80.5	150.3	308.6	68.6	82.3	308.5	2.0	N/A	5.8	0.4
Kiosk	361	0.8	80.5	150.3	308.6	68.6	82.3	308.5	2.0	N/A	5.8	0.4
The Dalton Highway Map	361	0.8	80.5	150.3	308.6	68.6	82.3	308.5	2.0	N/A	5.8	0.4
Yukon Crossing Map	361	0.8	80.5	150.3	308.6	68.6	82.3	308.5	2.0	N/A	5.8	0.4
Yukon Crossing VC	361	0.8	80.5	150.3	308.6	68.6	82.3	308.5	2.0	N/A	5.8	0.4
Overlook	389	0.7	55.9	131.4	324.3	61.3	61.3	293.2	6.5	N/A	6.5	2.1
Reading the Landscape	389	0.7	55.9	131.4	324.3	61.3	61.3	293.2	6.5	N/A	6.5	2.1
Fire Sparks New Life	389	0.7	55.9	131.4	324.3	61.3	61.3	293.2	6.5	N/A	6.5	2.1
Spanning the Yukon	361	0.7	80.5	150.2	308.7	68.6	82.2	308.4	2.0	N/A	5.8	0.4
The Dalton Highway Map	242	0.2	175.4	250.5	211.6	14.8	181.5	407.8	2.9	N/A	4.6	0.6
Atigun Pass	175	0.0	225.3	304.7	153.0	45.0	234.6	464.6	3.4	N/A	3.0	3.5

Source: BLM 2012.

Notes: [a] Values are greater than 0.0 but less than 0.05.

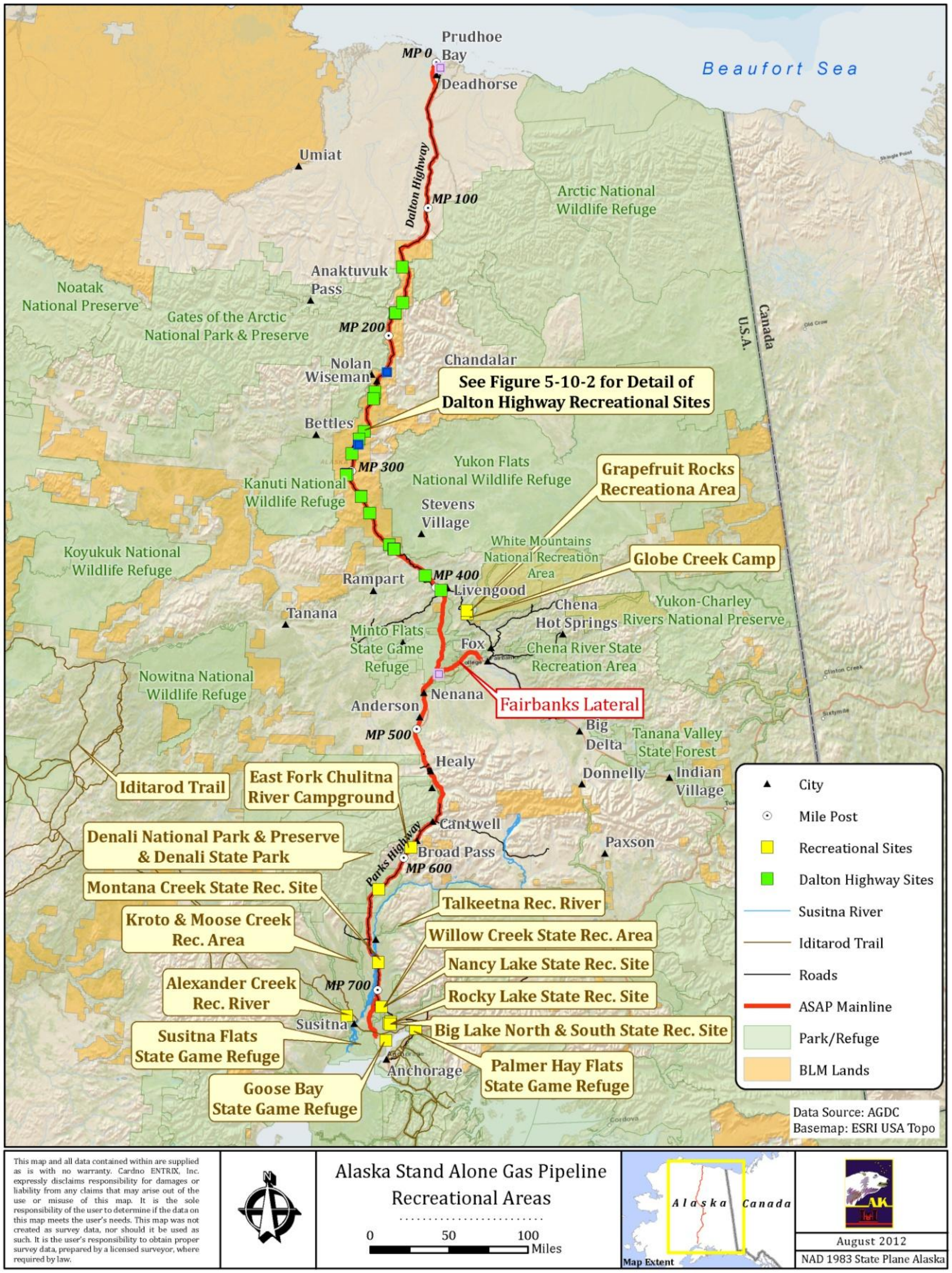
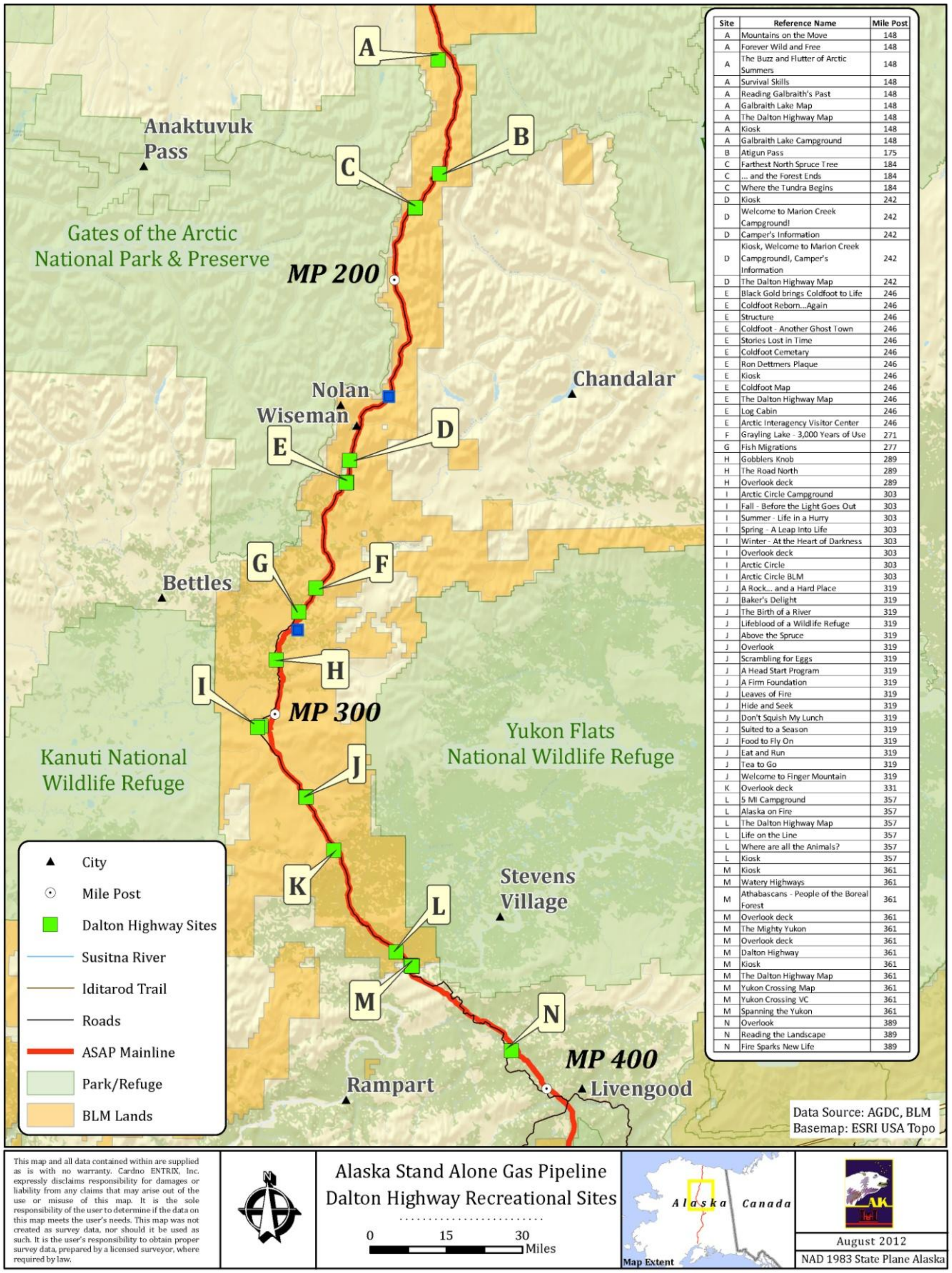


FIGURE 5.10-1 Recreation Areas



Site	Reference Name	Mile Post
A	Mountains on the Move	148
A	Forever Wild and Free	148
A	The Buzz and Flutter of Arctic Summers	148
A	Survival Skills	148
A	Reading Galbraith's Past	148
A	Galbraith Lake Map	148
A	The Dalton Highway Map	148
A	Kiosk	148
A	Galbraith Lake Campground	148
B	Atigun Pass	175
C	Farthest North Spruce Tree	184
C	... and the Forest Ends	184
C	Where the Tundra Begins	184
D	Kiosk	242
D	Welcome to Marion Creek Campground!	242
D	Camper's Information	242
D	Kiosk, Welcome to Marion Creek Campground!, Camper's Information	242
D	The Dalton Highway Map	242
E	Black Gold brings Coldfoot to Life	246
E	Coldfoot Reborn...Again	246
E	Structure	246
E	Coldfoot - Another Ghost Town	246
E	Stories Lost in Time	246
E	Coldfoot Cemetary	246
E	Ron Dettmers Plaque	246
E	Kiosk	246
E	Coldfoot Map	246
E	The Dalton Highway Map	246
E	Log Cabin	246
E	Arctic Interagency Visitor Center	246
F	Grayling Lake - 3,000 Years of Use	271
G	Fish Migrations	277
H	Gobblers Knob	289
H	The Road North	289
H	Overlook deck	289
I	Arctic Circle Campground	303
I	Fall - Before the Light Goes Out	303
I	Summer - Life in a Hurry	303
I	Spring - A Leap Into Life	303
I	Winter - At the Heart of Darkness	303
I	Overlook deck	303
I	Arctic Circle	303
I	Arctic Circle BLM	303
J	A Rock... and a Hard Place	319
J	Baker's Delight	319
J	The Birth of a River	319
J	Lifeblood of a Wildlife Refuge	319
J	Above the Spruce	319
J	Overlook	319
J	Scrambling for Eggs	319
J	A Head Start Program	319
J	A Firm Foundation	319
J	Leaves of Fire	319
J	Hide and Seek	319
J	Don't Squish My Lunch	319
J	Suited to a Season	319
J	Food to Fly On	319
J	Eat and Run	319
J	Tea to Go	319
J	Welcome to Finger Mountain	319
K	Overlook deck	331
L	5 MI Campground	357
L	Alaska on Fire	357
L	The Dalton Highway Map	357
L	Life on the Line	357
L	Where are all the Animals?	357
L	Kiosk	357
M	Kiosk	361
M	Watery Highways	361
M	Athabascans - People of the Boreal Forest	361
M	Overlook deck	361
M	The Mighty Yukon	361
M	Overlook deck	361
M	Dalton Highway	361
M	Kiosk	361
M	The Dalton Highway Map	361
M	Yukon Crossing Map	361
M	Yukon Crossing VC	361
M	Spanning the Yukon	361
N	Overlook	389
N	Reading the Landscape	389
N	Fire Sparks New Life	389

FIGURE 5.10-2 BLM-Administered Recreational Sites along the Dalton Highway

Public lands in Alaska are also generally conducive to dispersed[2] recreation activities that are located outside designated recreational areas. Dispersed recreational activities include hiking, primitive camping, nature study and wildlife viewing, fishing, cross-country skiing, snowmobiling/snowmachining, dog mushing, rafting/kayaking and swimming activities, which typically do not require the use of improved facilities. However, smaller-scale facilities are often available to support and compliment these dispersed uses, such as interpretive sites, trailheads, and locally-designated trails. Dispersed recreation use and facilities are prevalent along the proposed Project route. However, it is difficult to identify all uses and facilities due to the lack of documentation on dispersed use, as well as the extensive length of the route.

GCF to MP 540

The following recreation features are located between the Gas Conditioning Facility (GCF) at Deadhorse and MP 540 of the proposed pipeline.

Prudhoe Bay

Prudhoe Bay attracts a limited amount of public visitation. Access to the area between Deadhorse and Prudhoe Bay is restricted and tours are necessary to access the Arctic Ocean and surrounding oil fields. Tours are generally available by local tour guides between the end of May and beginning of September.

Dalton Highway Recreation Management Area

Dalton Highway Recreation Management Area (DHRMA) includes those public lands adjacent to the Dalton Highway from a point near the confluence of the Sagavanirktok and Ivishak rivers (about 60 miles south of Prudhoe Bay) and extending south to the Yukon River. The approximately 1.1 million acre DHRMA is managed by the BLM in accordance with the Recreation Management Plan for the Dalton Highway Recreation Management Area (BLM 1991), with an overall management objective of providing for a variety of developed and semi-primitive motorized recreation opportunities. The primary recreation activities during the summer include sightseeing, wildlife watching, hiking, camping, backpacking, and fishing, with hunting occurring during August and September. Recreational use declines substantially during the winter months and includes dog mushing, hunting and trapping, snow machining, and ski and dog sled touring. Recreation facilities within the DHRMA include the Yukon Crossing Contact Station (near the north end of the Yukon River Bridge), the Arctic Interagency Visitors center in Coldfoot (co-managed by BLM, NPS, and FWS) and four campgrounds (Five-Mile, Arctic Circle, Marion Creek, and Galbraith Lake campgrounds). In addition, the BLM manages approximately 20 sites with interpretive panels, 2 trails with interpretive panels, and 1 living history site within the DHRMA.

Recreational use along the Dalton Highway corridor is managed by BLM according to the benefits-based management planning framework, which focuses on recreation experiences and

[2] Dispersed recreation refers to passive outdoor recreation that occurs outside of developed sites of concentrated use.

benefits in addition to recreational activities. In order to gather more information about the four levels of recreation demand (desired activities, desired settings, desired experiences, and benefits) for summer visitors to the Dalton, Taylor, and Denali Highways and the Fortymile National Wild and Scenic River, the BLM funded the *Benefits-Based Management Study for the Dalton, Taylor, and Denali Highways* (Stegmann, et. al. 2008). In-person and follow-up surveys revealed that the activity most often cited as respondents' primary activity along the Dalton Highway was driving/sightseeing (49 percent). The majority (91 percent) of respondents stated that they intended to visit the southernmost portion of the highway (Yukon River up to the Arctic Circle), and visitation rates declined successively for each zone farther north of the Arctic Circle. The primary desired experiences for users of the Dalton Highway were reported to be to explore and experience nature, and the most desirable benefits were related to nature and the outdoors (Stegmann, et. al. 2008).

The Arctic National Wildlife Refuge

The Arctic National Wildlife Refuge, managed by the USFWS, is located in Northeastern Alaska. Because there are no roads in the Refuge, primary access is by air. However, Dalton Highway, located west of the ANWR boundary, also serves as a significant access corridor. ANWR is generally managed to protect its wilderness qualities as outlined in the *Arctic National Wildlife Refuge Comprehensive Conservation Plan* (USFWS 1988). Additionally, there is an area within the coastal plain of the Refuge with significant oil and gas resources referred to as "1002 area," which is considered a "Minimal Management" area. Management under this category is directed at maintaining fish and wildlife or other resource values, while maintaining opportunities for recreation. Generally, the wilderness qualities of the Refuge facilitate a number of recreation opportunities including hiking, hunting, camping, floating, and climbing. Total recorded visitation in ANWR was just over 1,000 in 2009 which is relatively consistent with numbers from visits in previous years starting with information from the 1980s. Of this total, approximately 88 percent of visitation is supported by commercial services of a guide and/or air operator (USFWS 2010).

Gates of the Arctic National Park and Preserve

The Gates of the Arctic National Park and Preserve is managed by the NPS. It is one of several conservation areas located in the Brooks Range in northern Alaska. The remote location and climate of the Brooks Range is conducive to extreme wilderness recreation activities such as backpacking, river running, mountaineering, and dog mushing. Other outdoor activities include camping, birding, and fishing and hunting. There are no developed facilities or trails in the park and no direct road access although the Dalton Highway is located just east of the park boundary. Most visitors access the park either by air taxi or by hiking in from the Dalton Highway. The park is open year round. Gates of the Arctic NPP is amending the 1986 General Management Plan (GMP) and the new plan will outline park management for the next 15 to 20 years. Since 2004 visitation to Gates of the Arctic NPP has remained relatively constant with nearly 10,000 visitors in 2009 (NPS 2009b).

Yukon Flats National Wildlife Refuge

The Yukon Flats National Wildlife Refuge is managed by the USFWS, and was established for multiple purposes, including: the conservation of fish and wildlife populations and habitats; fulfillment of international treaty obligations; continued subsistence uses; and protection of water quality and quantity. The refuge is open for public use, and common activities include boating, camping, hiking, fishing, hunting, wildlife viewing, and photography. River floating is another popular activity with access provided by the Yukon, Porcupine, Sheenjek, and other rivers. The refuge is not accessible by road, so visitor access is primarily by air or water-based transportation. Commercial recreation guides are also available.

Kanuti National Wildlife Refuge

The Kanuti National Wildlife Refuge is managed by the USFWS and was established to conserve white-fronted geese, other waterfowl and migratory birds, moose, caribou, and furbearers; fulfill treaty obligations; provide for continued subsistence uses; and ensure necessary water quality and quantity within the refuge. Hunting opportunities on the refuge are limited due to the closure of the Kanuti Controlled Use Area, which is open to subsistence hunting only. However, fishing opportunities are abundant on the refuge. Other recreation opportunities are limited because there are no designated trails, campsites, or public use cabins within the refuge boundaries, although some privately-owned lands and cabins exist near refuge lands. The refuge is managed pursuant to the *Revised Comprehensive Conservation Plan for Kanuti National Wildlife Refuge* (USFWS 2008).

White Mountains National Recreation Area

The White Mountains National Recreation Area is managed by the BLM and is located between Elliot and Steese Highways north of Fairbanks. At approximately one million acres, the White Mountains NRA offers opportunities for year-round recreation. Summer visitors typically engage in fishing, hiking, camping, and gold panning. In winter, visitors ski, snowshoe, dog team and snowmobile utilizing the area's trail system. Developed facilities include campgrounds, public-use cabins, trailheads, a gold-panning area, and a departure point for float trips. This area is currently managed under the White Mountain National Recreation Area RMP (BLM 1986), which is in the process of being integrated into the Eastern Interior Draft Resource Management Plan and Environmental Impact Statement (RMP/EIS).

Grapefruit Rocks Recreation Area

The Grapefruit Rocks Recreation Area is located on state land off Elliott Highway and managed by the ADNR. The area is a popular location for rock climbing, hiking, berry picking, and hunting. It has been considered for addition to the Alaska state park system.

Globe Creek Camp

The Globe Creek Camp is a private youth camp facility located north of Fairbanks. The 40-acre camp provides summer and winter camp programs to local youth. It includes a lodge, cabins, athletic fields, climbing wall, and a sledding hill. Globe Creek, a recreation resource itself, also traverses the property. Common recreation activities include hiking, obstacle course navigation, archery, sledding, and cross-country skiing. The camp is also in close proximity to hiking trails and areas for snowmobiling.

Tanana Valley State Forest

The Tanana Valley SF is managed by the ADNR and is located in the east-central part of Alaska, covering 1.81 million acres within the Tanana River Basin. This area is heavily forested and much of the forest is in timber production. The forest is also open to mining, gravel extraction, oil and gas leasing, and grazing. The Tanana Valley SF offers many recreational opportunities including hunting, fishing, trapping, camping, hiking, dog mushing, cross-country skiing, wildlife viewing, snowmobiling, gold panning, boating, and berry picking. This area is managed in accordance with the *Tanana Valley State Forest Management Plan* (ADNR 2001).

Minto Flats State Game Refuge

The Minto Flats State Game Refuge is managed by the ADF&G and was created pursuant to Alaska Statute 16.20.037. The Refuge encompasses approximately 500,000 acres, and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana. Access to the refuge is available from an extension of the local road network, by boat on the Tanana River, or by air via flights into refuge waters. There are no developed public use facilities such as campgrounds or picnic areas. Minto Flats has traditionally been an important area for harvesting fish, wildlife, and other resources for Alaska Natives and other local residents. Waterfowl hunting is particularly popular with the refuge producing the highest waterfowl harvest in the state and third highest number of waterfowl hunter days. The refuge is managed pursuant to the *Minto Flats State Game Refuge Management Plan* (ADF&G 1992).

MP 540 to MP 555

There are no developed recreation features located between MP 540 and MP 555 of the proposed Project route other than the Denali NPP, which is discussed under the Denali National Park Route Variation presented below.

Denali National Park Route Variation

The following recreation features are located along the Denali National Park Route Variation.

Denali National Park and Preserve, one of the primary visitor destinations in Alaska, is managed by the NPS and located in the interior of the state. The prominent feature at the park is Mt. McKinley, the tallest mountain in North America. The peak recreation season lasts from late May to early September. Common recreation activities at the park include backpacking and hiking, mountaineering, cycling, wildlife viewing and photography, sightseeing, fishing, camping, and whitewater rafting. During the winter season, additional recreational opportunities are available, including cross-country skiing, dog mushing, snowshoeing, and snowmobiling. Annual visitation to Denali NPP has averaged approximately 414,000 visitors between 2005 and 2009 (NPS 2009c). The park is managed in accordance with the *Denali National Park and Preserve Consolidated General Management Plan* (NPS 2008). Legislation and Congressional approval would be required to locate the pipeline through Denali NPP.

MP 555 to End

The following recreation features are located between MP 555 and the terminus of the proposed Project (MP 736.4).

East Fork Chulitna River Campground

The East Fork Chulitna River Campground is a primitive camping area approximately 0.4 mile north of the Parks Highway Bridge crossing, just south of Broad Pass, with restrooms and trash service. River access is available.

Denali State Park

Denali State Park is managed by the ADNR and is one of the prominent units in the Alaska State Parks system. The park covers 325,240 acres and is located north of Anchorage and south of Denali NPP along Parks Highway. It provides visitors with a great variety of recreational opportunities, which are served by developed facilities such as public use cabins (at Byers Lake), campgrounds (including Byers Lake Campground and Lower Troublesome Creek Campground), other lodging, scenic viewpoints, and trailheads. Common outdoor activities at the park include camping, kayaking, cross-country skiing, hiking, and fishing. Equipment rentals, tours, and guide services are also available. This park unit is managed pursuant to the *Denali State Park Management Plan* (ADNR 2006). In addition, ADNR is currently in the process developing trail management plan for the park. Denali SP has been identified as Section 6(f) property under the Land and Water Conservation Fund Act (see Section 5.10.1.1 for more information).

Talkeetna Recreation River, Little Susitna Recreation River, Kroto & Moose Creek, and Alexander Creek Recreation Rivers

The Talkeetna Recreation River, Little Susitna Recreation River, Kroto & Moose Creek, and Alexander Creek Recreation Rivers were established as part of the Recreation Rivers Act of 1988 (AS 41.23.400-510). The Act established mile-wide river corridors along the Little Susitna River, Deshka River (including Moose and Kroto creeks), Talkeetna River, Talachulitna River, Lake Creek, and Alexander Creek.[3] The *Susitna Basin Recreational Rivers Management Plan* (ADNR 1991a) was developed pursuant to the Act, which outlines long-term management strategies on state-owned lands surrounding designated river segments, establishes guidelines to reduce conflicts between users, provides opportunities for public use of the rivers, and protects the fish, wildlife, water, and other resources that drive visitation to these rivers. The management plan includes policies and guidelines related to general management intent; public use sites; special management areas; riparian management areas; recreation; fish and wildlife habitat; enforcement; commercial uses; shoreline development; and upland development. In the context of recreation, the management plan calls for limits on the duration of camping during the fishing season; a ban on new development of campgrounds; and development of primitive

[3] The Talachulitna River and Lake Creek Recreation Rivers have been established by the Recreation Rivers Act of 1988, but are not located in proximity to the proposed pipeline route.

facilities only where there is high public use. The management plan also outlines strategies for individual river systems along a recreation opportunity spectrum that include Class I (primitive recreation), Class II (semi-primitive), and Class III (developed recreation). The Talkeetna Recreation River is included in the management plan as Unit 3, and primarily has a Class II classification near the proposed pipeline. Little Susitna Recreation River is Unit 1 with both a Class I and Class III classification. Kroto and Moose Creek Recreation rivers consist of Units 2f and 2g respectively with predominantly a Class I classification. Finally, the Alexander Creek Recreation River is Unit 6 with both a Class II and Class III rating near the pipeline.

Montana Creek State Recreational Site

The Montana Creek State Recreational Site is managed by the ADNR and is an 82-acre unit located directly off of the Parks Highway. The main recreational activities are camping (36 campsites with RV access), fishing, and trail use, and picnic sites are also available. Although part of the Alaska State Parks system, management at Montana Creek State Recreational Site is contracted to a private concessionaire.

Willow Mountain Critical Habitat Area

The Willow Mountain Critical Habitat Area is co-managed by the ADF&G and ADNR and was created pursuant to Alaska Statute 16.20.620. It is located in the Talkeetna Mountain Range east of the Parks Highway between Willow Creek and the Kashwitna River. This remote area is open to public use and is a popular area for moose and ptarmigan hunters. Other recreation uses include dog-mushing, cross-country skiing, and snowmobiling, primarily in the winter. Limited fishing activity also occurs along Little Willow and Iron creeks.

Willow Creek State Recreation Area

The Willow Creek State Recreation Area is managed by the ADNR and is a developed recreation area located along the Parks Highway in the Susitna River valley north of Anchorage. At approximately 3,583 acres, its large land area and many water features are conducive to a variety of recreation activities, including camping (140 campsites with RV access), fishing, trail use, and wildlife viewing. Winter recreation also occurs at the Willow Creek SRA, and if the snow depth is adequate to protect underlying vegetation, this area may be opened for the use of snow vehicles (11 AAC 20.260). This SP unit is managed pursuant to the *Willow Creek State Recreation Area Master Plan* (ADNR 1990), which outlines management of recreation opportunities and makes recommendations for facility development to enhance recreation.

Nancy Lakes State Recreation Area and Site

The Nancy Lakes State Recreation Area and Site are managed by the ADNR and located north of Anchorage along the Parks Highway. The recreation area is over 22,000 acres in size and is characterized by a flat, lake-studded landscape that is preserved for recreation purposes. The area is conducive to canoeing, fishing, hiking and camping in the summer, and cross-country skiing, dog mushing and snowmobiling in the winter. Developed campground facilities, trailheads, picnic areas, and public use cabins are available. Included as part of the recreation area are the Nancy Lake Canoe Trail System and Nancy Lake State Recreation Site, which have a range of developed recreational facilities. Nancy Lakes SRA has been identified as Section 6(f) property under the Land and Water Conservation Fund Act (see Section 5.10.1.1 for more information). This State Park unit is managed pursuant to the *Nancy Lakes State Recreation Area Master Plan* (ADNR 1983), which was developed to ensure the continued provision of outdoor recreation opportunities; the existing Master Plan is currently in the process of being updated.

Rocky Lake State Recreation Site

The Rocky Lake State Recreation Site is managed by the ADNR and is contracted to a private concessionaire. It is located several miles off of the Parks Highway. Common activities at this 49-acre site include boating, camping (10 campsites), and fishing; it also has picnic sites and a boat launch.

Big Lake North State Recreational Site

The Big Lake North State Recreational Site is managed by the ADNR and is contracted to a private concessionaire. It is located 13 miles west of Wasilla, several miles off of the Parks Highway. It caters to seasonal recreation visitors. Boating and fishing are popular on the lake during the summer months, as are other water-based activities including water sports, such as water skiing, jet skiing, and swimming. The 19-acre facility also provides opportunities for land-based recreation including camping (60 campsites with RV access) and wildlife viewing during the summer, and snowmobiling, dog mushing, and cross-country skiing in the winter. Recreational facilities at the site include picnic shelters and a boat launch.

Big Lake South State Recreational Site

The Big Lake South State Recreational Site is managed by the ADNR and is contracted to a private concessionaire. It is a 22-acre site located adjacent to Big Lake North State Recreational Site near the southern terminus of the proposed pipeline. It also provides similar recreational opportunities to the Big Lake North State Recreational Site described above, including camping (20 campsites), fishing, boating, water skiing and jet skiing, and includes picnic sites and a boat launch.

Palmer Hay Flats State Game Refuge

The Palmer Hay Flats State Game Refuge is co-managed by the ADF&G and ADNR and was created pursuant to Alaska Statute 16.20.032. It is located north of Anchorage at the head of the Knik Arm of Cook Inlet and encompasses the mouths of the Knik and Matanuska rivers. Public access is available from the Glenn Highway and off Hayfield Road at Cottonwood Creek. It is a popular waterfowl hunting and fishing area (weekend fishery only). Boat launch areas are available at Knik River Bridge and Rabbit Slough landing on Wasilla Creek. Snowmobile activity is also allowed seasonally. The refuge is managed in accordance with the *Palmer Hay Flats State Game Refuge Revised Management Plan* (ADF&G 2002).

Susitna Flats State Game Refuge

The Susitna Flats State Game Refuge is managed by the ADF&G and was created pursuant to Alaska Statute 16.20.036. It is located between Beluga River and Point MacKenzie on the west side of Cook Inlet. It was created in part to ensure the protection of fish and wildlife populations, particularly waterfowl, moose, bear and salmon. Another role is to provide public use of these resources, including hunting, wildlife viewing, photography, and general public recreation. Each year approximately 10 percent of the waterfowl harvest in the state occurs on Susitna Flats. The Susitna River and its tributaries support the second largest salmon-producing system within Cook Inlet. Access is primarily by float plane or boat. Specifically, developed access is limited to the Little Su Public Use Facility within the Refuge, which provides boat access to the Little Susitna River; this is an ADF&G-owned facility that ADNR manages through a concessionaire. In addition, there are unimproved, road-accessible access points at several locations along the east boundary of the Refuge. The refuge is managed pursuant to the *Susitna Flats State Game Refuge Management Plan* (ADF&G 1998).

Goose Bay State Game Refuge

The Goose Bay State Game Refuge is managed by the ADF&G and was created pursuant to AS 16.20.030. It is located in upper Cook Inlet on the west side of Knik Arm across from Anchorage. Both road and boat access is available to the refuge, including a gravel parking lot at one access point that leads to a trail into the refuge. However, there are currently no improved public access points or public use facilities in the refuge. The wetlands complex provides a good waterfowl hunting area for local hunters. Off-road use of motorized vehicles is restricted in the refuge.

Iditarod National Historic Trail

The Iditarod National Historic Trail is administered by the BLM and managed by ADNR on state lands. It includes over 1,500 miles of the historic winter trail system open for public use across state and federal lands. The BLM, under the National Trails Act, is the designated Trail Administrator, although multiple agencies have management responsibilities on lands traversed by the trail. Public access is available year-round by rail, auto, or foot between the communities of Seward and Knik. General trail uses, such as hiking and wildlife viewing, are the primary recreational activities. The trail system is managed under the *Iditarod National Historic Trail Comprehensive Management Plan* (BLM 1986).

BLM Public Lands

BLM public lands are located throughout the proposed Project area. In the northern portion of the route, the pipeline would transect lands covered under the Utility Corridor RMP. These lands are managed for multiple uses although the priority of the plan is to facilitate transportation of energy minerals. Along the Parks Highway, the pipeline crosses lands managed under the Central Yukon RMP and East Alaska RMP. Lands in the Central Yukon RMP planning area that are in proximity to the proposed pipeline are conducive to dispersed recreation opportunities due to the remote character of this area; they also support hunting and fishing in primitive settings. Recreation management goals in the Central Yukon RMP planning area are to maintain existing recreation opportunities and support opportunities for increased public access. Finally, the East Alaska RMP provides management direction relative to a number of recreation resources within river systems including two components of the National Wild and Scenic Rivers system with 138 dispersed campsites; four campgrounds; two major waysides; and 24 developed trailheads (BLM 2006a, b). As public lands, much of the area covered under these RMPs supports a broad spectrum of dispersed recreation opportunities.

An extensive network of recreational trails is found on both public and private lands throughout the proposed Project area. Common recreational uses on Alaska trails include, but are not limited to, hiking/walking, bicycling, wildlife viewing, off-highway vehicle use, snowmobiling and cross-country skiing. Trail management is typically implemented as part of area- or facility-wide management plans, many of which are referenced above. In addition, proposed Project facilities would transect a number of trails in the Matanuska−Susitna Borough, including: Crooked Lake Trail; Flathorn Lake Trail; Iditarod Link; Iron Dog; Knik-Susitna Station Trail (Historic Iditarod Trail); Lucky Shot; Nancy Lake - Susitna Trail; Rolly Creek Trail; and the West Gateway Trail System. These local trail systems are managed under the *Willow Area Trail Plan* (2006), *Willow Summer Trails Master Plan* (2011), and the *Matanuska−Susitna Borough Recreational Trails Plan* (2008). Lastly, at a broader scale, ADNR administers the *Alaska Recreational Trails Plan* (ADNR 2000), which covers trail planning on State lands. Generally, these local and state-level trail plans identify trail systems in their respective regions, future trail needs, allowable trail uses, and funding and management considerations.

Fairbanks Lateral

The following recreation features are located along the Fairbanks Lateral. Other recreation features are located near this pipeline segment, but are referenced under the GCF to MP 540 segment, i.e., Minto Flats State Game Refuge and Tanana Valley SF.

Goldstream Public Use Area

The Goldstream Public Use Area is managed by the ADNR and was established by Alaska Statute 41.23.170. The purpose of the 2000-acre public use area located in the Goldstream Valley is to protect, maintain, perpetuate, and enhance year-round general public recreation, public use, and enjoyment of fish and wildlife. It is included within Management Unit 1H of the *Tanana Basin Area Plan* (ADNR 1991b) administered by the ADNR.

Creamer’s Field Migratory Waterfowl Refuge

Creamer’s Field Migratory Waterfowl Refuge, managed by the ADF&G, was created pursuant to Alaska Statute 16.20.039. It is a 1,800-acre bird sanctuary located in Fairbanks and associated with the Alaska Bird Observatory. The primary activity at the refuge is bird watching, although other recreation opportunities are also available, including a developed trail system that is used by hikers and for picnicking in the summer, and by dog mushers, cross-country skiers and skijorers (whereby a skier is drawn over ice or snow by a horse, dog, or vehicle) in the winter. Sections of the refuge are open to hunting and trapping during the appropriate seasons. Guided nature walks are also available, as well as a visitor center with historic exhibits and a gift shop. The refuge is managed pursuant to the *Creamer's Field Management Plan* (ADF&G 1993).

5.10.2 Environmental Consequences

This section addresses the impacts on recreation and tourism attributed to the construction and operation of the proposed Project and alternatives, including the No Action Alternative. Potential impacts are related primarily to effects on recreational access and quality of the recreation experience, and would vary in duration and magnitude. From a duration perspective, impacts are characterized as temporary or short term (primarily due to construction activities) and permanent or long term (associated with proposed Project operations). The magnitude of potential impacts is evaluated relative to existing conditions, outlined in Section 5.10.1, Affected Environment, and takes into consideration any proposed measures or activities that AGDC would implement as part of the proposed Project. The impact analysis presented below is organized by proposed Project alternative, facility, and phase.

5.10.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed. As a result, there would be no direct impact on existing recreation resources or temporary interruption in recreational activities in the proposed Project area and current recreation use and trends would continue. In addition, the potential for new access roads to open up additional areas to recreation would not be realized without the proposed Project. Indirectly, projected revenues for state and local governments would not be generated by the proposed Project, which could reduce spending on recreation management across the State relative to conditions with the proposed Project.

5.10.2.2 Proposed Action

The proposed action includes construction and operation of the proposed pipeline from the gas conditioning facility at Prudhoe Bay to the Cook Inlet Natural Gas Liquids Extraction Plant (NGLEP) Facility at the terminus of the route.

Pipeline Facilities

Mainline

The mainline portion of the pipeline is located primarily in transportation corridors, namely the Dalton and Parks Highways. These roadways facilitate access across Alaska serving both residents and non-resident visitors and are used extensively by recreationists to access their destination, including recreation areas in close proximity to the proposed Project. Generally, no recreation activity occurs directly in and adjacent to the roadways with the exception of sightseeing from vehicles and stopping at interpretive sites managed by BLM along the Dalton Highway. The pipeline route also requires multiple water body crossings, many of which support recreation activities.

Although the proposed pipeline alignment was designed to avoid recreation areas to the greatest extent practicable, the mainline pipeline would either cross, or be located within one mile from a number of key recreation features in Alaska, including Prudhoe Bay (MP 1), ANWR (MP 151), Marion Creek Campground (MP 242), Arctic Interagency Visitor Center (MP 246), Five Mile Campground (MP 357), Minto Flats State Game Refuge (MP 418-456), Tanana Valley SF (MP 425-469), Denali NPP (MP 538), East Fork Chulitna River Campground (MP 592), Denali SP (MP 609-646), Montana Creek SRA (MP 682), Willow Creek SRA (MP 708-709), Nancy Lakes SRA (MP 716), Little Susitna Recreation River (MP 730-731), and the Susitna Flats State Game Refuge (MP 734). In addition, the mainline pipeline would be located within one mile of numerous BLM-administered interpretive sites and waysides along the Dalton Highway corridor [see Table 5.10-2]. Multiple interpretative sites (MP 184, MP 246, and MP 271) would be located within 0.1 miles of the mainline pipeline, with one interpretive site (Farthest North Spruce Tree, MP 184) located less than 0.02 miles from the proposed mainline pipeline corridor. The mainline pipeline would cross the Atigun Pass (MP 175), where drivers cross the Continental Divide and watch for Dall sheep. In addition, both public and private land along the mainline route, outside designated recreation areas, is commonly subject to dispersed recreation activities. For a comprehensive discussion of recreation activities occurring at developed recreation sites and dispersed recreation opportunities, see Section 5.10.1.4.

Construction

Project construction could temporarily disrupt recreation activities and restrict recreational access along the pipeline route. Potential recreation impacts are attributed to shipment of construction materials, construction activity within the temporary ROW (e.g., use of heavy equipment and machinery), and influx of construction labor to the proposed Project area, all of which are discussed in more detail below. Construction is expected to occur over a 2 and a half year period (30 months); however, localized construction activity would be shorter in duration, limited to construction requirements across the various construction spreads and sections.

It is anticipated that the Port of Seward (Port), south of Anchorage, would serve as the point of entry for construction materials. The Port is also utilized by cruise ships embarking and disembarking from Alaska. The entry of construction materials to the Port is consistent with the industrial nature of the facility, but may adversely affect the recreation experience of cruise line passengers due to scheduling and/or other land use conflicts depending on the proximity and timing of utilization of dock facilities at the Port. AGDC will take into account all port activity when scheduling docking in Seward. The shipment of construction materials from the Port would be accomplished by water (barge), rail, and air, as well as along local roadways. Shipments using barge, rail or air would not likely affect recreation uses as the transportation options that would be utilized by the proposed Project already serve industrial uses and are not characterized by substantial recreation activity; therefore, there would be no conflicts between these types of transportation modes and recreation users. However, the use of public roads to transport pipe, heavy equipment, other construction materials, and personnel when other options are not available could result in potential impacts on recreation- and tourism-related travel due to temporary increases in traffic congestion along affected roadways primarily in the

Fairbanks, Palmer, Wasilla, and Anchorage areas. Such traffic may cause delays accessing recreation and tourism destinations along the pipeline route and elsewhere in Alaska.

Actual construction activity could also impair the recreation experience at areas along the pipeline route. Pipeline construction would require a standard 100-foot temporary ROW (up to 230 feet in some locations), including storage of topsoil. The presence of construction materials and activity would detract from the visual quality of the area and result in noise generation (e.g., overhead flights from helicopters and fixed wing aircraft associated with environmental and engineering fieldwork and use of heavy construction machinery), thereby reducing recreation quality of land- and water-based activities. There are particular concerns with construction reaches near isolated recreation areas, such as designated wilderness areas (e.g., Gates of the Arctic NPP) and fishing and hunting locales that are dependent on undisturbed environments. In addition, there could be direct effects from proposed Project construction that may affect recreation, such as: open cut of roads and streams that can result in temporary disturbance to some roads and trails (including section-line easements, R.S. 2477 trails, and Section 17(b) easements); restricted access to recreation areas, including navigable rivers, interpretive sites and waysides along the Dalton Highway, and designated trails; or potential adverse effects on fish and wildlife resources that provide the basis for much of the recreation in Alaska (for more information, refer to Section 5.5, Wildlife and Section 5.6, Fisheries).

In the context of water-dependent recreation, proposed Project construction would involve the pipeline ROW crossing approximately 495 waterways and drainages, of which 27 are major streams and 75 have been confirmed as anadromous streams. Crossing of water bodies would be accomplished by one of four methods: (1) open-cut method; (2) open-cut isolation method; (3) horizontal direction drilling; or (4) bridge crossings.[4] Project construction in and near water bodies could result in water quality impacts, generate noise and visual impacts, and restrict access to water bodies, all of which could diminish the quality of water-based recreation activities, such as floating, boating, and fishing.

The presence of a large construction workforce may also result in recreation impacts in some areas. The maximum size of the construction workforce is an estimated 1,600 workers spread out across approximately 15 stationary camps of 250 to 500 workers each. The temporary influx of new people to the region could result in competition for recreation facilities like campgrounds. Depending on the location and type of recreation facility, such an influx of people could also result in overcrowding, which could detract from the recreation experience. In addition, a temporary increase in the population base from construction workers serving the proposed Project may result in competing demands for local public services in some locales, including competition with tourists and recreational users in during high-use periods, which could detract from the recreational experience and adversely affect local tourism.

[4] For more information, refer to Section 5.2, Water Resources.

Overall, the proposed Project could result in short-term adverse effects on tourism and recreation, primarily attributed to a general decline in recreation quality, competition for local public services, and restricted access in proximity to the pipeline route during construction. These impacts are of particular concern during the peak recreation seasons, including salmon fishing in the spring and early summer and big game and waterfowl hunting in the fall. However, such impacts would be localized along the pipeline route and would last for the duration of construction in any one area. In addition, standard procedures have been incorporated into the proposed Project that would minimize potential impacts on recreation and tourism which address many of the issues outlined above, including measures related to restricting access, avoiding high-use periods and areas, and coordination between the public and the recreation and tourism industry; see Section 5.23 for further information.

Operations and Maintenance

The proposed pipeline ROW and associated facilities would directly affect a number of recreational areas, including Atigun Pass, Denali SP, Little Susitna Recreation River, Minto Flats State Game Refuge, Tanana Valley SF, and Willow Creek SRA. Proposed Project facilities would also transect a number of recreation trails, including the Iditarod Trail and other local trail systems. While the pipeline would be located underground and all existing public access points would be retained, there would be restrictions on access in some areas along the proposed ROW through the use of large boulders, berms, and/or fencing. This would detract from the natural environment characterizing many of these recreation areas and trail systems, thereby affecting the recreational experience of visitors. In addition, introducing a new ROW in these areas could also result in the establishment of unattended trails, which could affect public trail planning processes and trail designs. In terms of proposed Project operations, ongoing activities would include mowing and maintenance of vegetation resources along the ROW which would not likely affect recreation activity or the quality of recreation opportunities in proximity to the pipeline route. Further, no new public vehicular access routes are required for proposed Project operations, although there may be opportunities to include multi-use paths in the proposed Project design to address issues raised during public scoping; this would be a recreation benefit to the region. As a self-contained underground facility, generally, there also would be no externalities (e.g., dust and noise) from pipeline operations that would compromise the recreational quality of the region, although there could be minor disruptions to recreation activity during spill events or while conducting maintenance activities. Overall, there would be minor long-term adverse effects on tourism or recreation once construction is completed.

From a regulatory perspective, long-term operation of the proposed Project would require various permits, including permits in areas that have a recreation focus. For example, permits from the ADNR would be required for pipeline development in state park units and special area permits would be required from the ADF&G for lands under its jurisdiction. It is expected that permit conditions would include measures to minimize impacts on recreation activities occurring on these public lands. For this analysis, it is assumed that proponents of the proposed Project would secure and be in compliance with all applicable permits over the life of the proposed Project. In addition, proposed Project operations would not result in the long-term conversion of the pipeline corridor to non-recreation uses; therefore, there would be no conveyances of

Section 6(f) properties under the LWCF, specifically Denali SP, since the pipeline would be buried (C. LeClair, Pers. Comm. 2011).

Yukon River Crossing Options

The AGDC is considering three options for crossing the Yukon River: (the Applicant's Preferred Option) construct a new aerial suspension bridge across the Yukon River; (Option 2) attach the pipeline to the existing bridge; or (Option 3) utilize horizontal directional drilling beneath the Yukon River.

Construction of the proposed pipeline across the Yukon River would have similar impacts on recreation as those generally described above for the pipeline route, including potential short-term effects on the quality of recreation opportunities near construction activities. There are no developed recreation resources in proximity to the Yukon River crossing that would be directly affected by the proposed Project, including the small roadside rest area located immediately northwest of the existing highway bridge. However, recreation activities in the river itself, such as fishing and some water sports may be adversely affected during construction. The magnitude of potential recreation impacts is expected to be comparable under all three crossing options.

Fairbanks Lateral

The Fairbanks Lateral portion of the pipeline is located primarily in transportation corridors, (i.e., the Alaska Railroad and the Parks Highway). Along this route, the pipeline lateral would transect or be located less than one mile from the following recreation features: Minto Flats State Game Refuge (MP 418-456), Tanana Valley SF (MP 425-469), and Goldstream Public Use Area (MP 443).

Construction

Construction of the Fairbanks Lateral would be similar to the mainline portion of the pipeline route, including construction methods and measures to minimize impacts on recreation resources. Accordingly, the recreation-related impacts for the Fairbanks Lateral would be similar to those described above for the pipeline mainline, including potential short-term adverse effects on tourism and recreation in proximity to the pipeline route during construction.

Operations and Maintenance

Operation of the Fairbanks Lateral would be similar to the mainline portion of the pipeline route, including operating parameters, permit compliance, and measures to minimize impacts on recreation resources. As a result, the recreation-related impacts associated with operation and maintenance of the Fairbanks Lateral would be similar to those described above for the pipeline mainline; minor impacts on recreation and tourism are anticipated during proposed Project operations.

Aboveground Facilities

This section addresses aboveground facilities proposed as part of the proposed Project. Although not specifically referenced below, the construction and operation of such facilities may result in the development of access roads that can potentially open up new areas to recreation; this would be a recreation benefit of the proposed Project resulting from the establishment of new recreation opportunities that would be available to the public. All access roads would be managed pursuant to a comprehensive maintenance plan.[5]

Gas Conditioning Facility

The gas conditioning facility would be located near Prudhoe Bay. This area receives limited visitation, although tours of the oil fields and bay are available to visitors to the region. Recreation activity in the area is negligible.

Construction

Construction of the gas conditioning facility would not restrict access to any recreation features and is not expected to alter visitation patterns of people coming to the area. For this reason, no impact on recreation resources is anticipated during construction.

Operations and Maintenance

Long-term operations and maintenance of the gas conditioning facility would be assimilated into the industrial character of the region. Although the facility would be permanent, it would not adversely affect any recreation resources or activities, nor would it restrict access to Prudhoe Bay. Furthermore, the small size of the operations workforce comprising 10 workers at Deadhorse would not result in a substantial increase for recreation resources in the region and the development of new recreation facilities would not be warranted. No impacts to recreation resources are expected during proposed Project operations.

Compressor Stations

There would be a maximum of two compressor stations along the pipeline route located at MP 225.0, MP 285.5, or MP 466.5. The proposed compressor stations would be located less than one mile from the following recreation features: Tanana Valley SF and Minto Flats State Game Refuge. The compressor stations would be located no closer than 14.8 miles to the nearest campground (Marion Creek Campground, MP 242).

Construction

Construction of the compressor stations could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed sites. In

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[5] AGDC will develop a maintenance plan that will cover access roads built by AGDC and pre-existing roads used for access. AGDC will be responsible for maintenance of access roads purpose-built for the project, while agreements with owners of existing roads will specify maintenance responsibilities. Ownership of access roads for the project will be more precisely determined at the time of final right-of-way acquisition.

addition, there could be some effects associated with construction noise and landscape alteration which may reduce the aesthetic quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary, lasting only during the construction period.

Operations and Maintenance

The presence of the proposed compressor stations along the pipeline route would not restrict access to any nearby recreation features and is not expected to alter visitation patterns of people coming to the area. In addition, operations and maintenance activities associated with the compressor stations would not appreciably degrade the recreational quality of the region, although there would be visual and noise impacts associated with operation of the compressor stations. However, such impacts may adversely affect migration of game species, and therefore, may indirectly affect hunting activity in proximity to compressor station locations. In fact, potential compressor station sites, particularly the one located near the Gates of the Arctic NPP, could introduce additional noise, emissions, and activity in an area of the proposed Project and disrupt subsistence users and resources. These impacts could be exacerbated by employees working at the compressor stations, but it is not known whether these facilities will be staffed. Overall, there would be minimal long-term impacts to recreation resources during proposed Project operations.

Straddle and Off-Take Facility

The straddle and off-take facility would be located between MP 461.0 and MP 466.5. This facility would be located less than one mile from the following recreation features: Minto Flats State Game Refuge (MP 418-456) and Tanana Valley SF (MP 425-469).

Construction

Construction of the straddle and off-take facility could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed site. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary, lasting only during the construction period.

Operations and Maintenance

The presence of the proposed straddle and off-take facility would not restrict access to any nearby recreation features and is not expected to alter visitation patterns of people coming to the area. In addition, operations and maintenance activities associated with this facility would not appreciably degrade the recreational quality of the region. There would therefore be only minor long-term impacts to recreation resources during proposed Project operations.

Cook Inlet NGLEP Facility

There are no recreation features located within one mile of the Cook Inlet NGLEP Facility. The closest recreation feature is the Susitna Flats State Game Refuge (MP 734) approximately 1.6 miles away.

Construction

Construction of the Cook Inlet NGLEP Facility could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed site. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary, lasting only during the construction period.

Operations and Maintenance

The presence of the proposed Cook Inlet NGLEP Facility would not restrict access to any nearby recreation features and is not expected to alter visitation patterns of people coming to the area. In addition, operations and maintenance activities associated with this facility would not degrade the recreational quality of the region. The facility would require a permanent operations workforce of approximately 30 workers in the Wasilla area. The workforce would not result in a substantial increase for recreation resources in the region and the development of new recreation facilities would not be warranted, although there is the potential for an increase in recreation demand. There would therefore only be minor long-term impacts to recreation resources during proposed Project operations.

Mainline Valves and Pig Launcher/Receivers

The mainline valves and pig launcher/receivers would be sited in numerous locations along the pipeline route at approximately 20-mile intervals. As a result, these facilities would be located within or in close proximity (less than one mile) to several recreation features, including the ANWR (MP 151), Minto Flats State Game Refuge (MP 418-456), Tanana Valley SF (MP 425-469), Denali NPP (MP 538), Denali SP (MP 609-646), and Nancy Lakes SRA (MP 716).

Construction

Construction of the mainline valves and pig launcher/receivers could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed site. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary, lasting only during the construction period.

Operations and Maintenance

The presence of the proposed mainline valves and pig launcher/receivers would not restrict access to any nearby recreation features and is not expected to alter visitation patterns of people coming to the area. In addition, operations and maintenance activities associated with this facility would not appreciably degrade the recreational quality of the region. There would therefore be only minor long-term impacts to recreation resources during proposed Project operations.

Support Facilities

This section covers support facilities proposed as part of the proposed Project. Although not specifically referenced below, the construction and operation of such facilities may result in the development of access roads that can potentially open up new areas to recreation; this would be a recreation benefit of the proposed Project. All access roads would be managed pursuant to a comprehensive maintenance plan.

Operations and Maintenance Buildings

The specific locations of operation and maintenance buildings have not been defined at this time; therefore, it is not possible to identify recreation features that are proximate to these facilities.

Construction

Construction of the operations and maintenance buildings could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed site. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary lasting only during the construction period.

Operations and Maintenance

The presence of the proposed operations and maintenance buildings would not restrict access to any nearby recreation features and is not expected to alter visitation patterns of people coming to the area. In addition, operations and maintenance activities associated with this facility would not degrade the recreational quality of the region. There would likely not be any long-term impacts to recreation resources during proposed Project operations.

Construction Camps and Pipeline Yards

There are total of 15 construction camps and 26 pipeline yards planned to support the proposed Project. All of the construction camps would be located on previously disturbed sites up to 10 acres in size. The size of the pipeline yards range from two to 15 acres. The proposed construction camps and pipeline yards would be located within one mile from a number of recreation features, including interpretive sites and waysides along the Dalton Highway at MP 246, the Arctic Interagency Visitor Center (MP 246), Minto Flats State Game Refuge (MP 419-456), Tanana Valley SF (MP 425-469), Denali NPP (MP 538), and Denali SP (MP 609-646).

Construction

Development of the construction camps and pipeline yards could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed sites. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. The construction camps would provide housing to a workforce of approximately 250 to 500 workers in each location. As described above for the mainline pipeline, the temporary influx of workers to the region may result in an increased demand for recreation resources in the region and overcrowding at local recreational facilities; however, the development of new recreation facilities would not be warranted. These potential recreation impacts would be temporary lasting only during the construction period.

Operations and Maintenance

The proposed construction camps and pipeline yards would be removed once construction is completed and are not required during proposed Project operations. No recreation impacts are expected.

Material Sites

The proposed Project would require a substantial amount of sand and gravel, which would be extracted from material sites near the pipeline route. The exact locations of material sites are unknown, although a total of 546 existing material sites along the main alignment have been identified. The material sites being considered to support Project construction would be located within or adjacent to (less than 1 mile) a number of recreation features, including interpretive sites and waysides along the Dalton Highway at MP 242 and MP 246, Marion Creek Campground (MP 242), the Arctic Interagency Visitor Center (MP 246), the Minto Flats State Game Refuge (MP 418-456), Tanana Valley SF (MP 425-469), Denali NPP (MP 538), East Fork Chulitna River Campground (MP 592), Denali SP (MP 609-646), Talkeetna State Recreation River (MP 662), Montana Creek SRA (MP 682), Willow Creek SRA (MP 708-709), Kroto and Moose Creek Recreation River (MP 713), Nancy Lakes SRA and Site (MP 716, MP 707), Little Susitna Recreation River (MP 730-731), Goose Bay State Game Refuge (MP 736), and Palmer Hay Flats State Game Refuge (MP 736).

Construction

Similar to all support facilities, development of the material sites could result in temporary restrictions and delays accessing nearby recreation sites as materials are transported to the proposed sites. In addition, there could be some effects associated with construction noise and landscape alteration which may reduce the quality of the recreational experience for visitors to the region. These potential recreation impacts would be temporary lasting only during the construction period.

Operations and Maintenance

The proposed material sites would not be required during proposed Project operations and these lands would be available for recreation over the long term; therefore no impacts to recreation are expected.

5.10.2.3 Denali National Park Route Variation

If selected, the Denali National Park Route Variation would be developed in place of the corresponding MP 540 to MP 550 segment of the mainline pipeline. This alternative route would parallel the Parks Highway through Denali NPP.

Construction

Construction of the Denali National Park route variation would result in the same types of recreation impacts as those described above for the mainline pipeline. These impacts include short-term adverse effects on tourism and recreation attributed to restricted access to localized areas of the Denali NPP and the Yanert Valley during construction. Further, construction-related externalities, such as noise and traffic, may result in a short-term degradation in recreational quality in the immediate area, including effects on game species and related hunting opportunities. However, such impacts are minimized because construction would occur during the winter when there is little commercial and recreational activity in park. Furthermore, the Denali National Park route variation would be constructed in an area of the Denali NPP in which a low level of recreational use currently occurs (NPS 2012). Finally, there are standard procedures that have been incorporated into the proposed Project that would minimize potential impacts on recreation and tourism (see Section 5.23, Mitigation).

Operations

Similar to the mainline pipeline, operation of the pipeline with the Denali National Park route variation would not result in adverse effects on recreation and tourism as it would be located primarily underground and would not restrict access or compromise the recreational experience in the surrounding area. Legislation and Congressional approval would be required to locate the pipeline through Denali NPP.

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5.11 VISUAL RESOURCES

This section describes existing visual resources in the proposed Project area, which extends along a linear route from Prudhoe Bay to Cook Inlet in Alaska, and assesses the potential impacts to visual resources that may result from development of the proposed Project. To gauge the extent of potential impacts, an overview of the types and location of visual resources and management in the proposed Project area is presented in Section 5.11.1, Affected Environment. The impact analysis presented in Section 5.11.2, Environmental Consequences, focuses on the extent to which pipeline construction and operations would affect visual resources in proximity (defined generally as within 5 miles) to the pipeline route. The impact analysis is based on the location, duration, and visual contrast of construction and operations activities.

5.11.1 Affected Environment

Visual resources are landscape characteristics that have an aesthetic value to local residents and visitors based on their perspective from sensitive viewpoints, such as residences, recreation areas, rivers, or highways. This section discusses the existing visual resources along proposed Project routes considered in this FEIS and the proximity of the pipeline routes to potentially sensitive viewpoints and user groups in order to gauge viewer sensitivity. It also identifies special management and regulatory considerations for visual resources in the proposed Project area. The purpose of the information presented here is to establish existing conditions relative to visual resources, which provides context to identify potential short- or long-term changes to the visual environment resulting from proposed Project construction and operations.

5.11.1.1 Regulatory Environment

The regulatory environment associated with visual resources focuses primarily on management guidelines for public lands in the proposed Project area. The proposed Project area includes federal, state, and private lands. There are no applicable visual resource management guidelines or methodologies to assess the visual impacts to the existing landscape on private or state lands. In contrast, there are management guidelines for federal lands. The Bureau of Land Management (BLM) is charged with managing the scenic resources of public lands through the Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C 1732). FLPMA states that the scenic quality of federal lands should be protected for the enjoyment of all Americans. To this end, BLM has developed the Visual Resource Management (VRM) system to manage visual resources. Furthermore, the proposed Project area includes a National Scenic Byway and several State Scenic Byways, which recognize scenic resources in the proposed Project area. The proposed Project would not cross any river sections designated as wild and scenic. Guidance for management of federal lands and federally designated scenic resources is described below.

BLM Visual Resource Management

The VRM methodology has been developed to identify and evaluate scenic resources under BLM's jurisdiction and to develop management objectives for those resources. The system classifies resources based on scenic quality, viewer sensitivity to visual change, and viewing distance (BLM 1980a, 1984, and 1986a). Based on these three visual criteria, each location is placed into one of four VRM inventory classes with different visual resource management objectives. Classes I and II are the most valued, Class III represents a moderate value, and Class IV is of least value:

- The Class I objective is to preserve the existing character of the landscape, including the natural ecological qualities. Some very limited management activity is permitted.
- The Class II objective is also to preserve the existing character of the landscape and to keep landscape changes at a minimum. Landscape changes should reflect the ambient colors, textures, and form of the surrounding features.
- The Class III objective is to keep landscape changes moderate and retain some portion of the existing character of the landscape. Management activities should not attract much attention or dominate the view. Landscape changes should reflect the basic features found in the landscape character.
- The Class IV objective is to allow management activities that require major alterations in the existing character of the landscape. The view may be dominated by management activities. However, the location, disturbance, and blending with the surrounding landscape should be minimized.

Few lands in the proposed Project area have an established VRM Class rating. This analysis reviews the visual resources based on the general guidelines used to establish VRM classes, but does not determine an Interim VRM Class for lands that are not under BLM jurisdiction and/or have not been assigned a VRM Class. Described below are the VRM guidelines for BLM lands in the proposed Project area as described in the applicable BLM Resource Management Plans (RMPs).

BLM Utility Corridor RMP

The proposed Project area includes the Utility Corridor which extends along Dalton Highway milepost 56 to milepost 300, and provides a route to transport petroleum. The Utility Corridor was established in 1971 by Public Land Order 5150 and dedicated to long-term utility and transportation needs. In January 1991, the BLM Alaska Arctic District Office issued a Record of Decision on the Utility Corridor Resource Management Plan/Environmental Impact Statement (RMP/EIS) that recognizes that, "the primary management direction and use of the BLM-administered lands in the Utility Corridor is for energy transportation," and that, "management must allow for activities which would require major modification of the existing landscape" (BLM 1991). According to the RMP/EIS, management of inner corridor lands is to be managed according to Class IV VRM objectives, with every attempt to be made to minimize visual impacts, particularly in high quality (Class A) scenic areas and Areas of Critical Environmental Concerns (ACECs), which include Galbraith Lake and Sukakpack Mountain.

BLM Central Yukon RMP

The Central Yukon RMP guides management of 9.5 million acres in west-central Alaska. The BLM is currently developing an RMP for the Eastern Interior Planning Area, which will replace the Steese National Conservation Area RMP (1986b), White Mountain National Recreation Area RMP (BLM 1986c), and the Fortymile Management Framework Plan RMP (1980b). The existing RMPs specify that visual resources will be managed where possible to retain the existing character of the landscape. However, no VRM inventory has been conducted in this planning area.

BLM East Alaska RMP

Land within the East Alaska RMP/Final EIS planning area, south of the BLM Central Yukon RMP area, is managed to protect and enhance vegetative communities, fish and wildlife resources, recreational opportunities, and natural, cultural, and geological resources (BLM 2006). The BLM established VRM inventory classes in the East Alaska planning area in 2003. The proposed Project mainline would overlap with the East Alaska RMP planning area minimally, with approximately 7.4 miles of pipeline crossing lands covered by East Alaska RMP planning area lands. Of this mileage, 0.3 miles are categorized as Class II, 6.0 miles are categorized as Class III, and 1.1 miles are categorized as Class IV.

Denali National Park and Preserve

The Consolidated General Management Plan for Denali National Park and Preserve (NPP) stipulates that visitor centers and other facilities in the built environment will reflect the wild setting, with designs that consider the effects of scale, materials, color, texture, and continuity so as to minimize visual impacts to park visitors. It is also notes that incompatible uses in the National Park include surface disturbing activities that “unduly change the visual character of the park and preserve.” The General Management Plan notes that the Alaska Power Authority (APA) has constructed an intertie transmission line between Willow and Healy, with lines and towers that are partially visible from the national park entrance. The General Management Plan recognizes that this corridor will be “the defined route for other future utility transmission from Anchorage to Fairbanks, and the NPS will continue to work with the APA to mitigate the visual impacts of any future development along the Parks Highway and the park boundary” (NPS 2011).

National Scenic Byways Program

Congress established the National Scenic Byways Program in 1991 to designate roads with distinctive natural, scenic, historic, cultural, archaeological, or recreational qualities unique to their regions. The vision of the Federal Highway Administration’s National Scenic Byways Program is “to create a distinctive collection of American roads, their stories and treasured places.” The National Scenic Byways Program does not provide management guidance, but rather its mission is, “to provide resources to the byway community in creating a unique travel experience and enhanced local quality of life through efforts to preserve, protect, interpret, and promote the intrinsic qualities of designated byways" (FHWA 2011). The Parks Highway, which is a 323 mile byway that connects Anchorage and Fairbanks, is a National Scenic Byway that provides views of the Alaska Range and Mount McKinley.

Alaska Scenic Byways Program

The State of Alaska established a scenic byways program in 1993 to recognize routes that provide access to the state's significant scenic, cultural, and recreational resources. There are two State Scenic Highways in the proposed Project area: the Dalton Highway (entire length) and the George Parks Highway (from Healy to the southern boundary of Denali State Park [SP]). Corridor partnership plans are developed locally by local governments and citizens "to identify key features along the byways and to enhance and promote those features over time." The Dalton Highway Scenic Byway Corridor Partnership Plan, completed in March 2010 (ADNR 2010), is an evaluation of the byway's intrinsic qualities (including scenic) and serves as a guideline for the protection of these intrinsic qualities over time. It is not a plan that mandates regulations for viewsheds, nor does it provide guidance for use of the corridor for pipelines and other utility infrastructure. Similarly, the Corridor Partnership Plan for the Parks Highway developed in 2008 is not a regulatory document, but rather contributes to the communities and places of interest along the corridor by promoting tourism, supporting the local culture, and enhancing the economic base of the region.

5.11.1.2 Overview of Visual Resources by Segment

The proposed Project would cross a variety of landscapes, including the Arctic Coastal Plain, the Brooks and Alaska mountain ranges, the Tanana Flats, the Nenana River Valley, and the Susitna River Valley. This landscape contains a diversity of vegetation and landcover types, including tundra, wetlands, waterways, dwarf scrub/shrub vegetation, and boreal forest. The proposed action also crosses or parallels a number of travel routes, recreation areas, and populated areas that may be visually impacted. The pipeline parallels two designated scenic byways: the state- and federally-designated Parks Highway Scenic Byway and the state-designated Dalton Highway Scenic Byway. The Denali National Park Route Variation parallels the Parks Highway through the eastern section of Denali NPP. The proposed Project route would not traverse Denali NPP, but would traverse the Minto Flats State Game Refuge, Susitna State Recreational River, Willow Creek State Recreation Area, and Denali SP. All other routes would transverse a State Game Refuge and State Recreation Areas.

The route crosses numerous minor roads, trails, railroads, and rivers (although no rivers would be crossed in sections designated as Wild and Scenic). Figure 5.11-1 shows the Scenic Byways, National Parks and Wildlife Refuges, and Wild and Scenic Rivers in the vicinity of the proposed Project. Table 5.11-1 below summarizes the travel routes and observation points from which the proposed Project could be visible. The remainder of this section summarizes visual resources by segment.

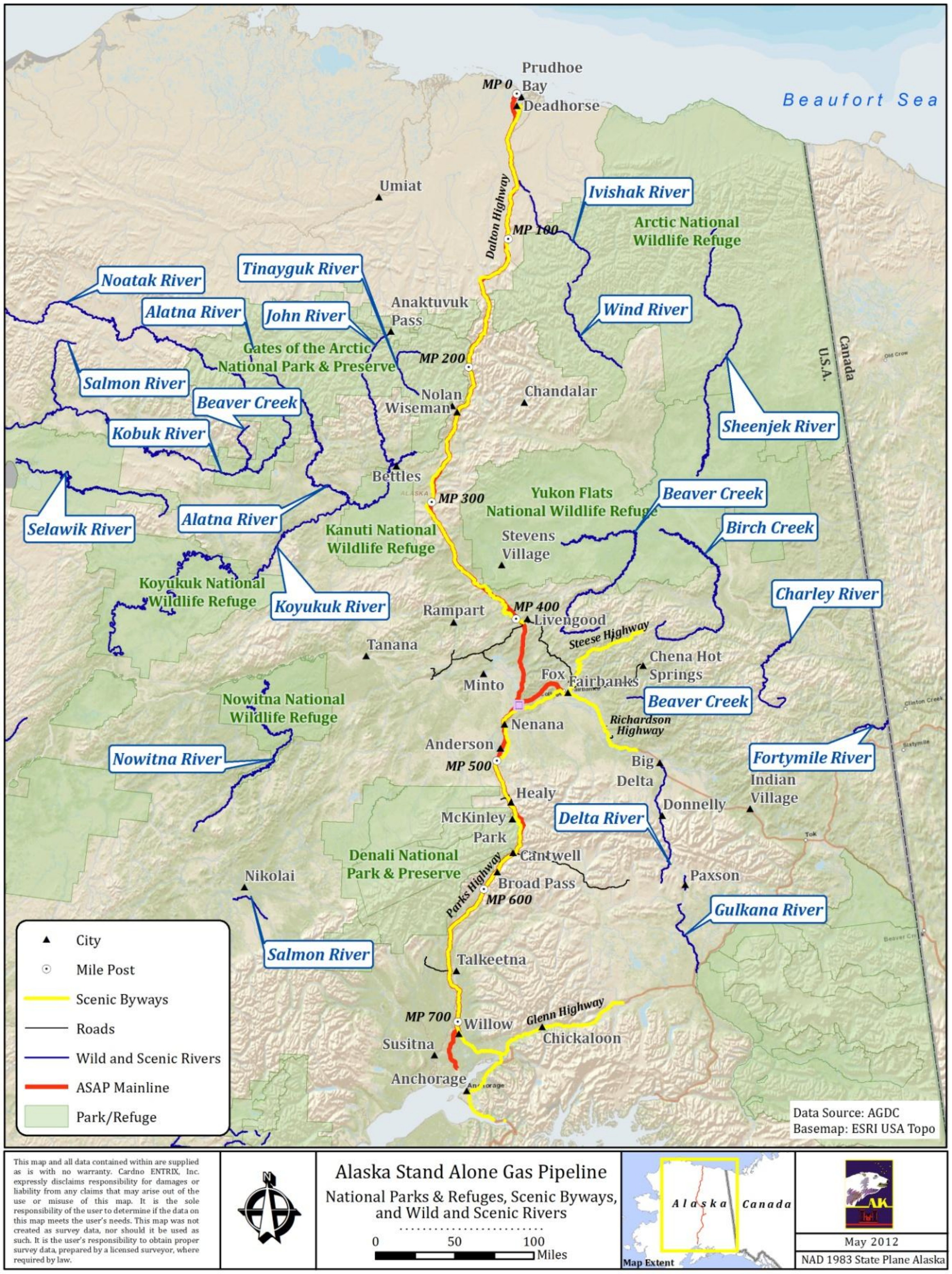


FIGURE 5.11-1 Scenic Byways, National Parks and Wildlife Refuges, and Wild and Scenic Rivers in the Vicinity of the Proposed Project

TABLE 5.11-1 Pipeline Proximity to Travel Routes or Observation Points

Travel Route or Observation Point	Description of Proposed Action Proximity	Segment				
		ASAP MP 0 to MP 540 (Parks Highway MP 238)	Fairbanks Lateral	ASAP MP 540 to MP 555 (Parks Highway MP 238-223)	Denali NP Route Variation	ASAP MP 555 (Parks Highway MP 223) to End
Populated Areas	Mileage of proposed Project within town or CDP Boundaries	91	18	16	15	101
	Acreage of Census Designated Place/Town within 5 miles of proposed Project	420,398	42,358	54,531	47,005	428,449
Scenic Byway	Proposed Project crossing (underground)	37	0	0	0	6
	Mileage of proposed Project within Byway ROW	253	0	0	15	123
Railroads	Proposed Project crossing (underground)	5	3	0	2	5
Local/Arterial Roads	Proposed Project crossing (underground)	138	3	1	NA	63
Trail/Driveway	Proposed Project crossing (underground)	102	6	1	NA	199
Rivers	Proposed Project crossing (nearly all underground)	400	19	6	4	90
Recreation Areas	Acreage within 5 miles of proposed Project: State Recreation (Forest, Park, Public Use Areas, Recreational Areas, Recreation River)	166,918	72,725	0	0	243,811
	Acreage within 5 miles of proposed Project: State Game Refuge	131,810	4,418	0	0	20,209
	Miles of Historic Trail within 5 miles of proposed Project	0	0	0	0	10
	Acreage within 5 miles of proposed Project: National Wildlife Refuge/National Park	144,547	0	38,968	48,003	78,913
	Miles of proposed Project within State Recreation Areas/Site/Park	15	2	0	0	40
	Miles of proposed Project within State Game Refuge	24	0	0	0	0
	Miles of proposed Project within National Wildlife Refuge /National Park	0	0	0	7	0

GCF to MP 540 (Parks Highway MP 238)

The proposed Project would follow the James B. Dalton Highway (Dalton Highway) for approximately 400 miles. The Dalton Highway, which is designated as an Alaskan scenic byway, begins just a few miles from Prudhoe Bay and ends approximately 414 miles to the south at its junction with the Elliot Highway. This primarily gravel road was originally constructed at a width of 28 feet, but is narrower in some sections due to erosion and wider in some new sections. It is the only road connecting the Beaufort Sea to the area south of the Yukon River. The Dalton Highway was completed in 1974 by the Alyeska Pipeline Service Company. Its original name was the Haul Road, indicating its purpose to support pipeline construction and maintenance and to provide access to the oil fields as part of the Trans Alaska Pipeline System (TAPS). The TAPS is predominantly visible from the Dalton Highway as it winds along (and sometimes underneath) the highway. The TAPS is a mostly aboveground pipeline in a maintained 54-foot Right-of-Way (ROW). Control of the Dalton Highway was transferred to the State of Alaska in 1978, and in 1994 was opened the highway to general public use.

In terms of potential viewer sensitivity and numbers, there are an estimated 20,000– 25,000 recreational visitors traveling to the North Slope annually, with additional commercial truck traffic transporting supplies (ADNR 2010). There is also limited bicycle travel on the highway. Several small communities are located along the highway as well, and are described below.

The Dalton Highway traverses a diversity of landscapes and provides views of numerous significant natural features. The following are depictions of these features from the Dalton Highway Scenic Byway Corridor Partnership Plan (2010):

- <u>Arctic Coastal Plain</u> (Deadhorse to Last Chance Wayside). Permafrost seals the ground and creates ice features including layers of ice (aufeis), ice-wedge polygons up to 100 feet in diameter, ice-core mounds (palsas), and conical ice-cored hills (pingos) up to 1,450 feet wide and 230 feet high. The landscape also includes vast wetlands and thaw lakes. The copper-colored Franklin Bluffs can be seen in the northern reach of this section. Buildings and oilfield infrastructure are also visible at the northern terminus at Deadhorse/Prudhoe Bay.
- <u>North Slope</u> (Last Chance Wayside to Galbraith Lake). The remote North Slope is a treeless coastal plain characterized by a vast expanse of low-lying tundra plants. Key natural features in this section are the Sagavanirktok River and Slope Mountain (located at the southern edge of the North Slope). Visible to the south are the mountains of the Brooks Range.
- <u>Brooks Range</u> (Galbraith Lake to Coldfoot). The landscape in this section of the Dalton Highway through the Brooks Range is dominated by mountain peaks and river valleys. The Gates of the Arctic NPP and the Alaska National Wildlife Refuge (ANWR) are visible from the highway. Natural features in this section include Sukakpak Mountain (a recognizable marble rock peak in the Brooks Range), Atigun Pass (elevation 4,739 feet,

where the Dalton Highway crosses the Continental Divide), Atigun River Valley, and Galbraith Lake.

- Boreal Forest (Coldfoot to Livengood). In this section, the Dalton Highway rolls up and down through the hills and valley bottoms of the Yukon-Tanana uplands. Vegetation includes spruce and birch forests, bogs, creeks, as well as signs of wildfire. This section includes a crossing of the Yukon River (MP 361), views of Yukon Flats NWR, the Arctic Circle, Kanuti NWR, Finger Mountain (rock pinnacles rising straight from the tundra), and Grayling Lake (glacially carved). Two small communities, Coldfoot and Wiseman, are located along this section of the Dalton Highway, with residential and commercial structures providing a visual contrast to the undeveloped surroundings.

The Dalton Highway ends soon after pipeline Mile Post (MP) 400, and the pipeline continues south following minor travel routes and the Tolovana River through the Tanana Lowlands, which is an alluvial plain that slopes gently upward towards the Alaska Range. Permafrost in this area is discontinuous and vegetation is dominated by boreal forests, with such species as black spruce, white spruce, balsam poplar, white birch, and trembling aspen in various microenvironments. This section of the route also includes a crossing of the Tanana River, after which the proposed pipeline would begin to parallel the Parks Highway. At this point, the proposed pipeline would enter a more developed environment with more visual contrast with infrastructure and buildings following paved highway through several communities. For example, soon after crossing the Tanana River, the proposed Project route would pass through the communities of Nenana and Healy, as well as other populated but incorporated places located adjacent to the Parks Highway. From MP 0 to MP 540 (Parks Highway MP 238), 90.5 miles of the proposed route would pass through populated areas (as defined by the U.S. Census Bureau as a town or Census Designated Place)—the majority of which are located toward MP 540. In these populated places, the areas immediately adjacent to the proposed route typically include existing linear utility and road corridors.

In addition to proximity to highway travel, in this segment the proposed Project would cross a railroad track five times, as well as approximately 140 local and arterial roads. Over 100 RS 2477 trails would be crossed, which provide access to rural destinations and are utilized primarily in the winter by snow-machines, dogsled teams, and four-wheel all-terrain vehicles. For more information on RS 2477, refer to Section 5.9, Land Use.

Fairbanks Lateral

The Fairbanks Lateral traverses from Nenana to Fairbanks, up the Goldstream Valley, parallel to the Alaska Railroad (ARR), to the north of the Parks Highway. The route passes through rolling hills or domes covered with dwarf scrub vegetation and open spruce stands. In this segment, the proposed Project would cross (underground) a freight and passenger railroad three times and would cross (underground) three roads, two of which are crossed at the same locations as two of the railroad crossings. There are six ditch crossings of driveways/trails.

MP 540 to MP 555 (Parks Highway MP 238 to 223)

The landscape in this segment continues to be rolling hills and dwarf scrub vegetation and boreal forests. In the southern section of this route, the Nenana River is visible to the west. The Alaska Range is visible along much of this segment. The Alaska Range landscape visible from this portion of the route and from the Denali National Park Route (NPR) Variation is predominantly rocky slopes, ice fields, and glaciers barren of vegetation. In this segment, the proposed Project would cross two arterial/local roads.

Denali National Park Route Variation

This route variation continues to parallel the Nenana River and the Parks Highway (Figure 5.11-2). Approximately 6.7 miles of the route extends through the eastern edge of Denali NPP. Dwarf scrub communities are common where vegetation does exist. The entire route variation passes through a populated place (within a town or Census Designated Place as classified by the U.S. Census Bureau), with developed structures and infrastructure located along the route and particularly concentrated at the community of McKinley Village near the south entrance to Denali NPP along the Parks Highway. In this route variation, the proposed Project would cross a freight and passenger railroad track two times.

MP 555 to End

This route segment continues to the east of the Parks Highway and detours around the boundaries of Denali NPP before rejoining the Parks Highway north of Cantwell. This segment through to Cantwell passes through a populated place with developed structures and infrastructure. The Alaska Range landscape is visible through this segment and further to the south: predominantly rocky slopes, ice fields, and glaciers barren of vegetation. Dwarf scrub communities are common where vegetation does exist.

To the south of Cantwell, significant natural features include Broad Pass, an unforested, low elevation pass that provides views of valleys and Alaska Range mountain peaks as well as Byers Lake. Farther to the south, the route parallels the Middle Fork of the Chulitna River and passes through Denali SP, which provides views of the Mount McKinley summit on clear days. Soon after, the route begins paralleling the Susitna River, which flows to Cook Inlet. As the route approaches its terminus, the landscape becomes level to hilly, with vegetation dominated by spruce and hardwood birch forest. The route stays within populated areas for most of the remaining 100 miles and includes such settlements as Trapper Creek and Willow. Natural features visible from the southern route include the Talkeetna Range to the east and numerous lakes, including Nancy Lakes, Rock Lake, Big Lake North, and Big Lake South. From Willow, the route leaves the Parks Highway and follows the Susitna and Little Susitna river valleys.

As the most populated area of the proposed Project, this segment would cross a comparatively high number of travel routes. It would cross a railroad track in five locations, arterial/local roads approximately in 210 locations, and trails or driveways in nearly 200 locations. This segment would also cross 7.4 miles of BLM lands with the following VRM classifications: 0.33 miles of Class II, 6.0 miles of Class III, and 1.1 miles of Class IV (see Figure 5.11-3).

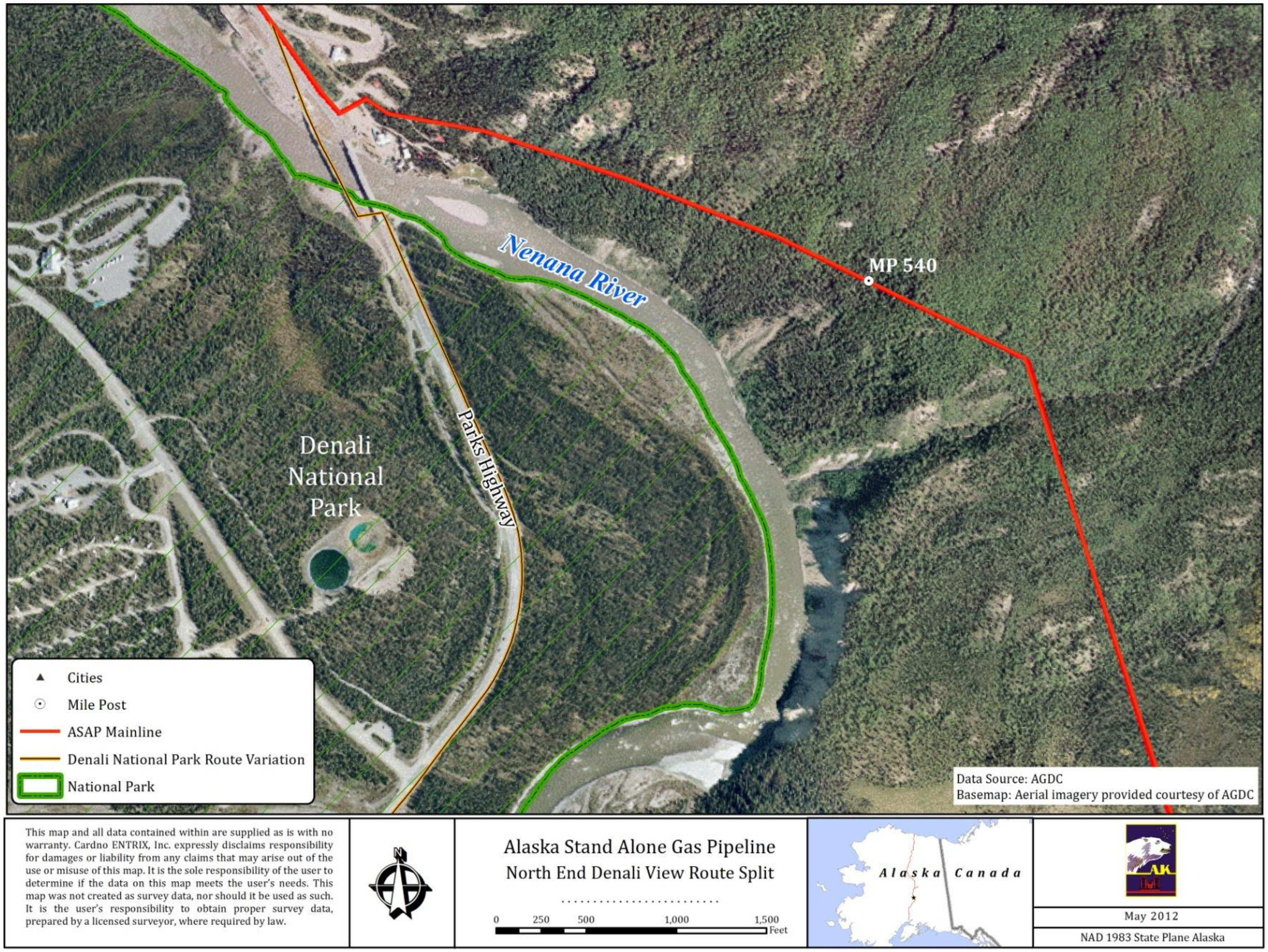


FIGURE 5.11-2 North End Denali National Park Route Variation

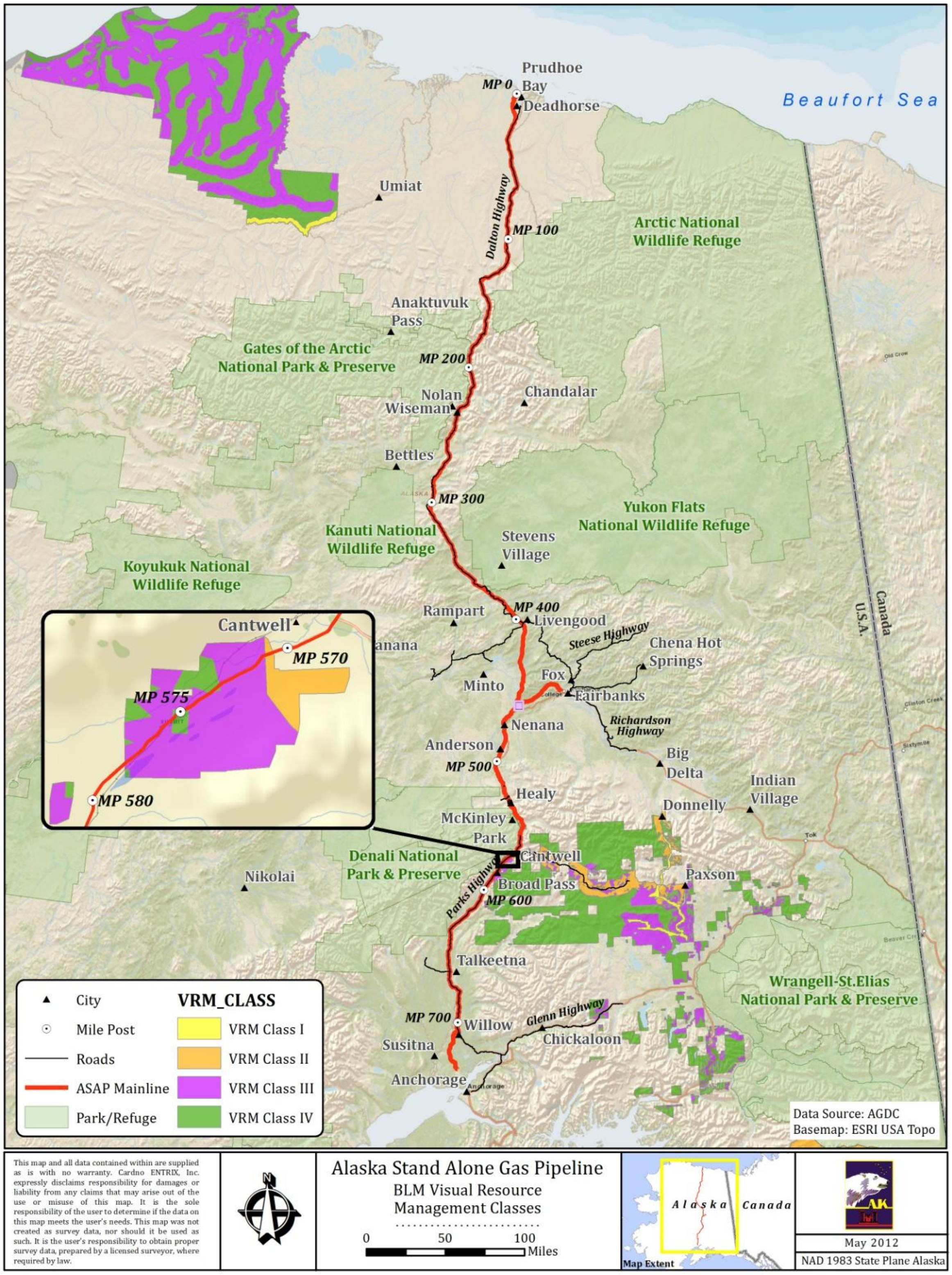


FIGURE 5.11-3 BLM Visual Resource Management Classes

5.11.2 Environmental Consequences

This section addresses the impacts to visual resources that are expected from the construction and operation of the proposed Project. Visual impacts are typically analyzed by studying how a project would contrast with the existing landscape and its scenic quality and associated viewer sensitivity. Contrast is influenced by the distance of the viewer from a proposed project, angle of observation, length of time a project is in view, size and scale, season during which it is seen, light conditions, spatial relationship, vegetation recovery time, and atmospheric conditions. Impacts from the proposed Project construction, operations, and maintenance facilities would therefore be greatest in areas of high visual scenic quality, high viewer sensitivity (as indicated by type and level of use and designated scenic or special areas), and high visual contrast (as indicated by changes in line, form, color, or texture) due to pipeline construction and/or operations.

5.11.2.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed. As a result, there would be no impact on existing visual resources in the proposed Project area.

5.11.2.2 Proposed Action

The proposed action includes construction and operation of the proposed pipeline from the gas conditioning facility (GCF) at Prudhoe Bay to the Cook Inlet natural gas liquids extraction plant (NGLEP) facility at the terminus of the route. Short-term visual impacts would be higher during construction and re-vegetation than during the operations and maintenance phase of the proposed Project. The analysis of construction phase impacts is confined to impacts that would occur from construction-related equipment, workers, and activity. The VRM methodology includes vegetation recovery time as a factor in determining visual contrast, and recognizes that recovery usually takes several years. If recovery extends over long time periods in excess of several years, the VRM methodology recommends that contrast ratings be conducted for each vegetative recovery phase. This analysis identifies contrast during and immediately following the construction timeframe, expected to last approximately 1–2 years, as well as the long-term operations timeframe. The analysis of operations phase impacts focuses on structures, equipment, and activities that would be present 5 years following construction.

Short-term impacts that would be associated with construction include extra workspace, clearing and removal of existing vegetation in the ROW, exposure of bare soils, earthwork, trenching, and machinery and pipe storage. As discussed throughout this section, these short-term impacts would increase visual contrast through changes in color (particularly removal of vegetation), form (through earthwork and presence of construction equipment), and line and texture (areas with aboveground pipeline). Long-term impacts during operations would be associated with maintenance of access in the ROW, various landform changes including earthwork and rock formation alteration, pipeline markers, and new aboveground structures located along the route such as compressor stations, mainline valves (MLVs), pipeline inspection gage (PIG) launchers/receivers, and a straddle and off-take facility. Operations structures would also be located at the northern and southern end points of the route: at the northern starting point there would be a GCF, and at the southern terminus there would be a NGLEP facility. Long-term impacts would increase visual contrast through changes in form (through earthwork and aboveground facilities) and line and texture (areas with aboveground facilities).

Nearly the entire proposed Project would be below ground and follow existing utility ROWs and roads. Many of the new structures and landform and vegetation changes during construction and operation would be visible to travelers along the major transportation corridors in the vicinity of the proposed Project, including the Dalton Highway and the Parks Highway as well as railroad and river corridors. Although recreational travelers are generally more sensitive to changes in scenic quality, views of proposed Project structures or landform alterations would typically be limited to short periods of time and small portions of the ROW. During the final stages of construction, backfilling and grading would restore the construction ROW to its approximate previous contours and visual resource mitigation would reclaim and re-vegetate to emulate natural vegetative cover and edges such that the ROW would ultimately return to its approximate previous condition except in currently forested areas. With the exception of two MLVs, no aboveground facilities would be located in recreation areas. Overall, most of the proposed pipeline facilities would be located in areas with existing linear infrastructure, including highways, railroads, pipelines, and power lines, which would reduce the visual impact of the proposed pipeline ROW and associated facilities, particularly once construction and restoration is complete. It should be noted that viewer sensitivity is limited in this region to the late spring, summer, and early fall as the remaining part of the year experiences limited lighting conditions and inclement weather, thus reducing recreational use of the various regional travel routes and inhibiting views of the proposed Project (see Section 5.23, Mitigation).

Pipeline Facilities

Viewer sensitivity to the proposed pipeline facilities would be highest in locations where such facilities are visible from nearby recreation areas, travel corridors used by tourists and recreationists, and residential areas (see Table 5.11-1 above). Impacts to viewer sensitivity in or near recreation areas or travel corridors would be greater during the higher use summer tourist season, while viewer sensitivity in dispersed recreation locations may be greater during higher use periods such as during the summer and fall fishing and hunting seasons.

Mainline

All but 6 miles of the proposed mainline pipeline route would be buried underground. The mainline portion of the proposed pipeline is located primarily in transportation corridors, namely the Dalton and Parks highways. Approximately 208 miles of the proposed mainline pipeline passes through populated areas from which the ROW would be visible. Other linear features such as roads and power lines, as well as dispersed residential and commercial structures, occur throughout these areas, reducing the visual contrast of the mainline ROW in populated areas. The route would cross over 500 local and/or arterial roads and trails from which the ROW would be visible.

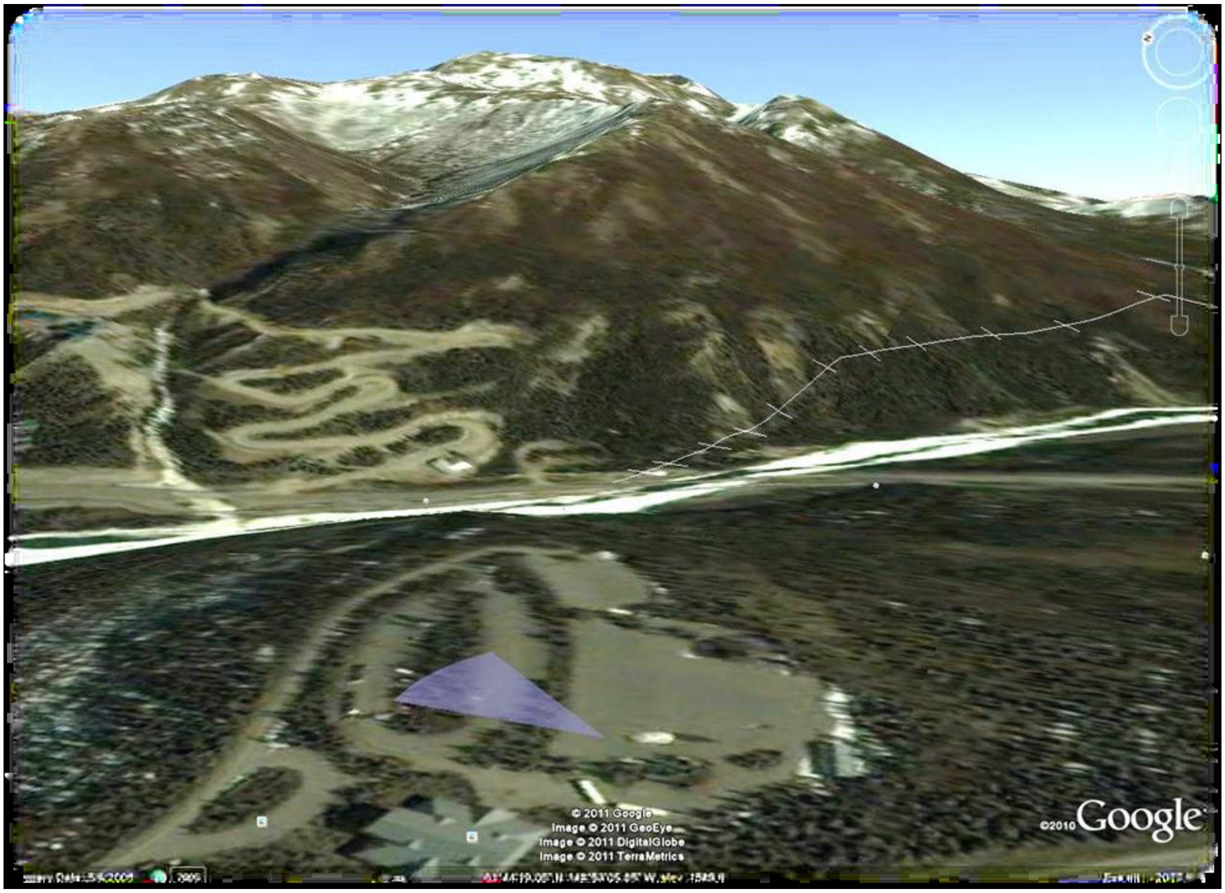
The ROW would also be visible from some BLM and state recreation sites, as well as from some areas in Gates of the Arctic NPP, Denali NPP, and Denali SP. Due to high scenic quality and high recreation and tourist use of the area (with consequent high visual sensitivity) near Denali NPP and Denali SP, this area would have the highest potential along the route for visual impacts.

Construction

Visual contrast during construction of the proposed Project would result from earthwork and exposure of bare soils due to clearing and removal of existing vegetation in the 100 foot ROW, the presence of construction workers and vehicles, and the storage of construction materials. Construction materials and activity would contrast visually with the surrounding environment, particularly in undeveloped areas. Construction would be expected to occur over a 2.5 year period (30 months); however, localized construction activity would be shorter in duration, limited to construction requirements across the various construction spreads and sections.

Construction of the proposed mainline pipeline facilities would result in short-term visual impacts in transportation corridors throughout most of its length. Most of the landscape changes caused by the proposed Project pipeline facilities would be visible as linear changes to vegetation patterns or hill cuts. As described in Section 5.9, Land Use, the most common vegetation types that would be temporarily affected during proposed Project construction are scrub/shrub (3,214 acres) and forest (3,887 acres), based on a 100 foot construction ROW.

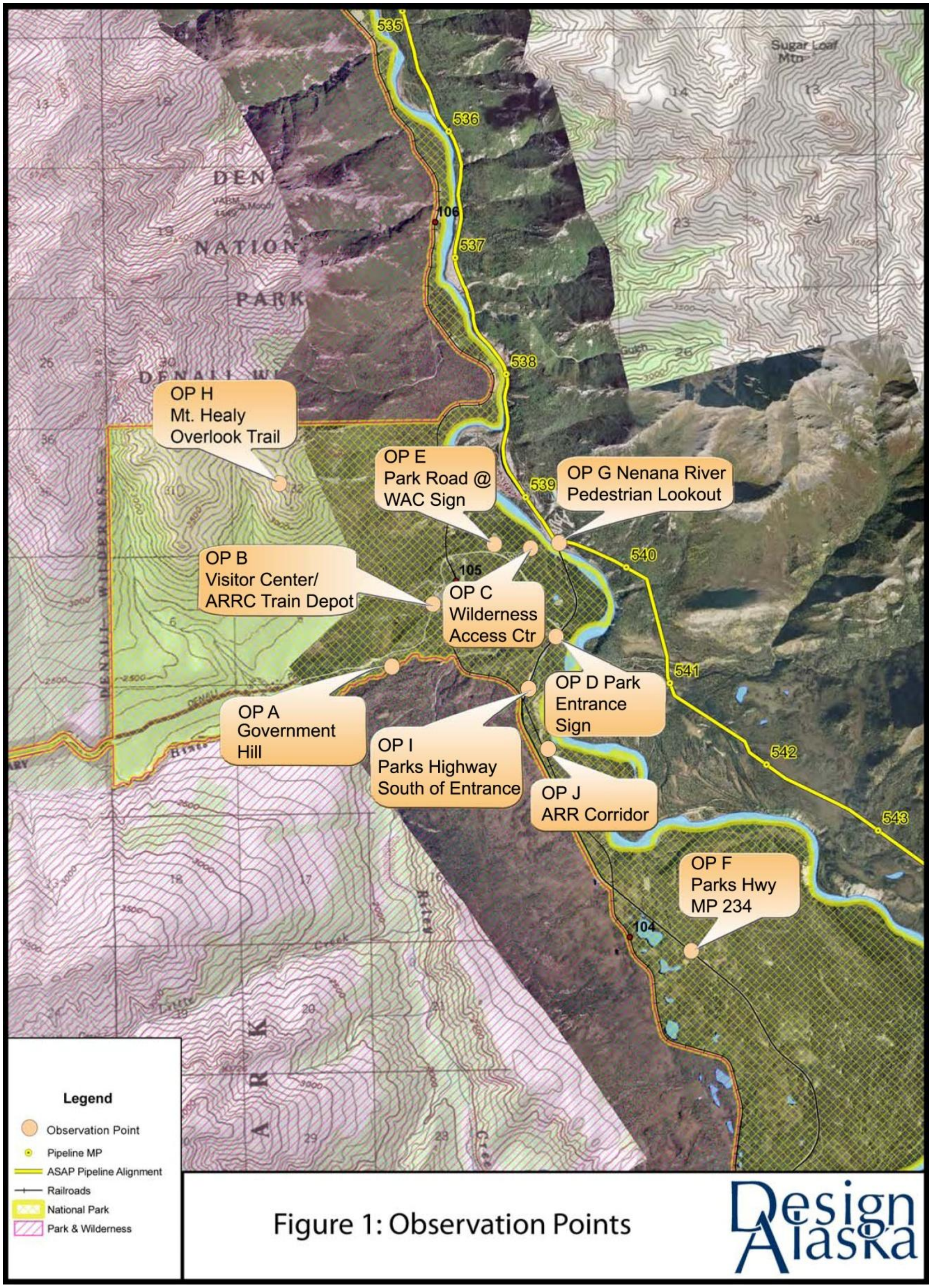
Areas with substantial earthwork and hill cuts in the vicinity of high use recreation or residential areas would have the highest visual impacts. In particular, the section of the mainline immediately north and south of MP 540 (Parks Highway MP 238), where the route departs from the Parks Highway and traverses a side slope through steep terrain, would create visual contrast that would be visible to users of the Parks Highway and from the Parks Road within the Denali NPP at Government Hill. Figure 5.11-4 depicts the proposed pipeline ROW and Parks Highway in the area south of MP 540 (Parks Highway MP 238). Side hill cut construction requires cutting the uphill side of the construction ROW, and using the material from the cut to fill the downhill side of the ROW to provide a level surface within the ROW. Due to the volume of cut material and the equipment required, the ROW could be up to 260 feet wide in other areas (as depicted in Figure 2.2-7). Visual contrast would be created by the removal of vegetation and source material, resulting in exposed soils, which would contrast with the natural forest structures of the surrounding landscape. Furthermore, the linear ROW cut would change the form and line of the hill from a gentle slope and curve to a flat form and sharp lines, resulting in strong visual contrast. Because the soil is covered by vegetation in the existing landscape, the soil texture and color exposed by the hill cut would have a strong contrast to the surrounding predominantly green vegetation as seen from some key vantage points. Figure 5.11-4 provides an overview of this area and the proposed pipeline route; as shown in the figure, this area has existing commercial development and linear features which reduce the visual contrast of the proposed route.



Source: Design Alaska 2012.

FIGURE 5.11-4 Google Earth Three Dimensional Model

A separate analysis conducted for the AGDC by Design Alaska (2011a) assessed visual impact of the proposed Project in the area of Denali NPP from MP 538 to MP 552 (Parks Highway MP 240–226) in the vicinity of this hill cut (see Appendix K). The Design Alaska analysis identified 10 observation points based on potential visual impact of the proposed Project from three user groups: visitors to Denali NPP, Parks Highway travelers, and ARR passengers. Figure 5.11-5 highlights these observation points. Following fieldwork, five of these observation points (including the Denali NPP visitor center) were eliminated from further analysis due to lack of visibility of the proposed Project and/or lack of importance of minimizing visual impacts due to surrounding commercial development. The analysis focused on visual impact of the proposed Project from the remaining six key observation points (KOPs): Government Hill along the Park Road, the ARRC Train Depot, the Wilderness Access Center, Parks Highway South of Entrance, Mount Healy Overlook Trail, and the ARR corridor. The analysis identified interim VRM classes in the proposed Project area visible from these KOPs as VRM Class II and Class III.



Source: Design Alaska 2011a.

FIGURE 5.11-5 Visual Resources Observation Points in Vicinity of Denali National Park and Preserve

The Design Alaska analysis conducted visual simulations for both construction and operations phases at each of the six KOPs. Based on these simulations and the contrast rating conducted at each KOP, the analysis found that impacts to KOPs resulting from proposed Project activities would most likely occur between MP 538.5 and MP 540.2 (Parks Highway MP 240.5 to 238.2), with moderate visual contrast at the Government Hill KOP and moderate to strong visual contrast at the Parks Highway South of Entrance KOP. Impacts at the four other KOPs were rated as weak.

Existing visual conditions and simulations of the proposed Project during construction as viewed from the Government Hill KOP are portrayed in Figures 5.11-6 and 5.11-7, while Figures 5.11-8 and 5.11-9 portray simulations as seen from the Parks Highway South of the Entrance. As shown in the figures, the proposed Project creates line and color contrast as seen from both locations, which is strongest during the construction phase.

Source: Design Alaska 2011a.

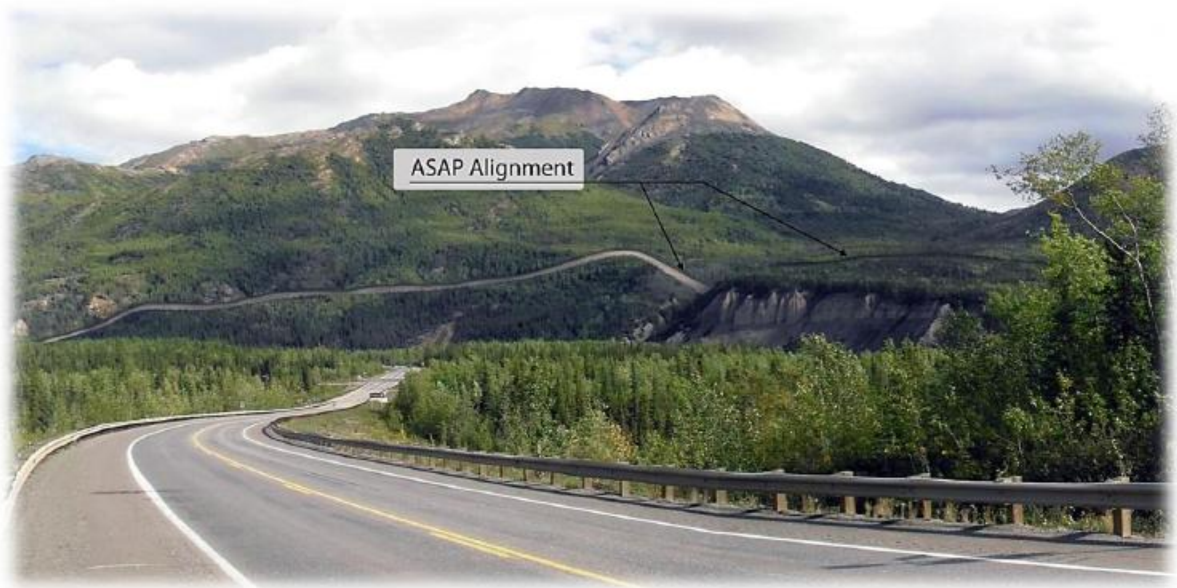
FIGURE 5.11-6 View of Existing Conditions from Government Hill KOP

Source: Design Alaska 2011a.

FIGURE 5.11-7 Simulated View from Government Hill KOP in Construction Phase

Source: Design Alaska 2011a.

FIGURE 5.11-8 View of Existing Conditions from Parks Highway South of Entrance KOP



Source: Design Alaska 2011a.

FIGURE 5.11-9 View of Parks Highway South of Entrance KOP in Construction Phase

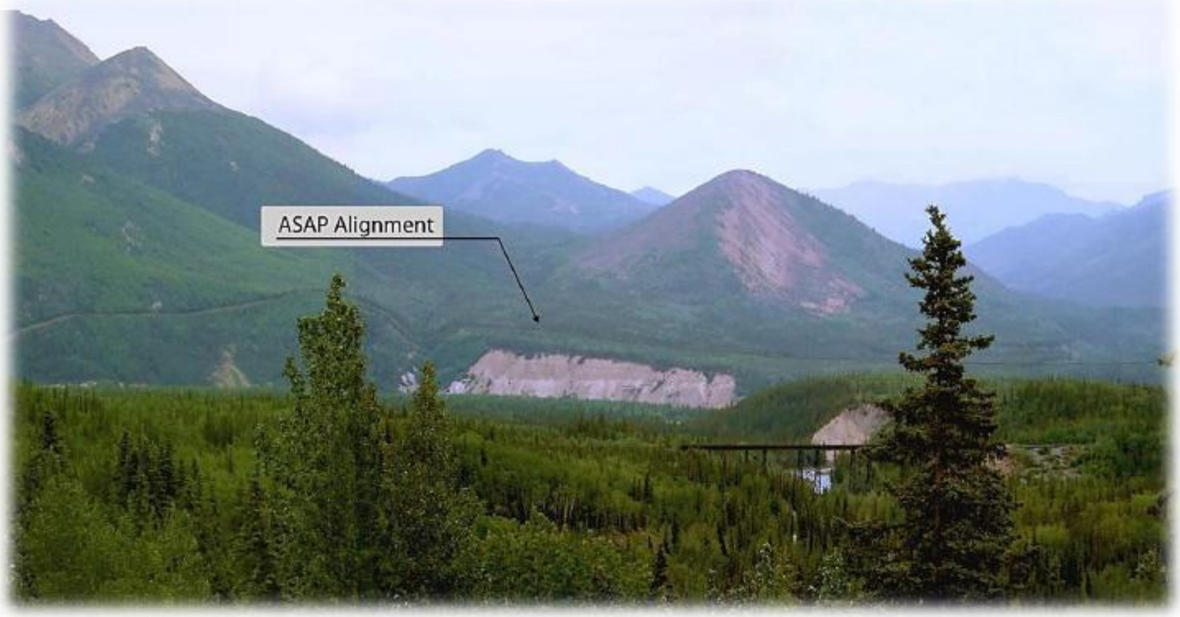
The proposed pipeline in this area crosses BLM lands from MP 548 to MP 549 (Parks Highway MP 230–229). The BLM lands crossed by the proposed Project or to the east of the proposed Project are classified as Class III and Class IV. The hill cut would modify the character of the landscape, but following construction and re-vegetation, it is expected that Class III and IV objectives would be met from surrounding BLM lands.

Operations and Maintenance

Operation of the proposed pipeline would involve movement of natural gas within a buried pipeline, with limited maintenance activities. A long-term 51 to 52 foot ROW on federal lands and a 30 foot ROW on all other lands would be maintained. The long-term ROW would impact an estimated 1,066 acres of scrub/shrub and 1,340 acres of forest, based on a 52 foot federal lands ROW and a 30 foot state/private lands ROW. Because the proposed pipeline would be located underground and the ROW would be re-vegetated, long-term visual impacts would be limited in most areas. Following re-vegetation, the ROW located in scrub/shrub vegetated areas would return to approximate previous conditions, while ROW located in forested areas would be visually altered due to the absence of tree re-vegetation. However, even in forested areas, for the majority of the route in which the proposed pipeline ROW is located within existing travel corridors, visual impacts are expected to be low. Existing travel corridors themselves are not forested, and there would thus be weak contrast to landscape form, line, texture, and color from the proposed pipeline ROW within the travel corridor.

During the operations and maintenance phases, visual contrast from the proposed pipeline facilities would be greatest in areas requiring hill cuts and new bridge crossings over rivers that would result in long-term modifications to landscape form and line. As described above, the hill cut on the proposed mainline pipeline with the greatest potential visual impacts is near MP 540

(Parks Highway MP 238), where the proposed mainline route diverges east of the Parks Highway. Following construction, the hill cut area would be re-vegetated, reducing textural and color contrast from the surrounding landscape. However, moderate to high visual impacts would remain from modifying the form of the landscape from a curving slope to a sharp line of the linear, level ROW. This area would be visible from the Parks Highway as well as from the eastern edge of Denali NPP lands. Simulations of the visual impact of the proposed Project as seen from the Government Hill KOP in Denali NPP and the Parks Highway South of Entrance KOP are provided in Figures 5.11-10 and 5.11-11.

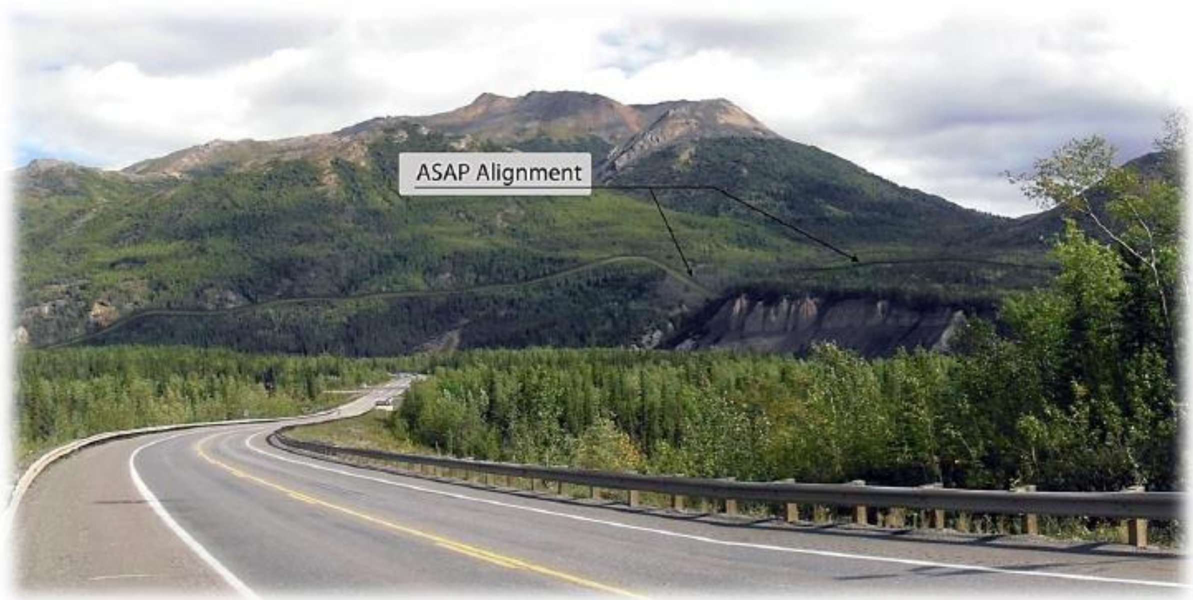


Source: Design Alaska 2011a.

FIGURE 5.11-10 Simulation of Government Hill KOP in Operations Phase

From MP 570 to MP 578 (Parks Highway MP 208–MP 201), the proposed mainline pipeline would cross 7.4 miles of BLM lands with VRM designations of Class II, III, and IV. Near MP 570, (Parks Highway MP 208) 0.33 miles of proposed pipeline would cross VRM Class II lands, with the remaining lands traversed being Class III or Class IV (see Figure 5.11-3). No hillcuts or aboveground segments would be anticipated in this section, indicating that long-term visual impacts would likely be low and would be consistent with VRM management objectives.

A few maintenance workers and vehicles are expected to be present occasionally along the mainline. The visual impact of these workers, vehicles and associated activities are anticipated to be minor, due to their temporary nature and the expectation that their presence would have low visual contrast to other elements of the proposed Project.



Source: Design Alaska 2011a.

FIGURE 5.11-11 Simulation of Parks Highway South of Entrance KOP in Operations Phase

The proposed mainline pipeline itself would also be potentially visible long-term at four aboveground waterbody crossings. The AGDC has proposed the use of three existing bridge crossings: Chulitna River Bridge, Coal Creek Bridge, and Hurricane River Bridge. Visual impacts on existing bridge crossings would be expected to be low, as the pipeline infrastructure would be expected to blend in with the existing linear bridge structures and provide weak contrast to viewers traveling on bridge roadways or traveling in the river corridor.

Yukon River Crossing Options

The AGDC has proposed three options for crossing the Yukon River. The AGDC would either: construct a new aerial suspension bridge across the Yukon River (the Applicant's Preferred Option); cross the Yukon River by attaching the pipeline to the existing E.L. Patton Bridge (Option 2); or utilize Horizontal Directional Drilling (HDD) to cross underneath the Yukon River at the location of the proposed suspension bridge (Option 3). If a new Yukon River bridge were constructed, moderate to high visual impacts would result for travelers on the Dalton Highway and at the rest area on the shores of the river. The proposed bridge structure would contrast with the natural landscape; the strong lines and smooth textures of the bridge would contrast with the rough and irregular surrounding vegetation and landform. See Figure 5.11-12 for a rendering of a new bridge for the Yukon crossing.

FIGURE 5.11-12 Simulation of Yukon Crossing on New Suspension Bridge

If the pipeline were attached to the existing E.L. Patton Bridge, visual impacts would be expected to be low, as the pipeline infrastructure would hang below the bridge surface, blending in with the existing linear bridge structure and provide weak contrast to viewers traveling on the bridge roadway or traveling in the river corridor.

The feasibility of a HDD crossing is unknown at this time due to limited soils information. The impacts to visuals resulting from the use of the HDD method to cross the Yukon River would be negligible.

Fairbanks Lateral

The Fairbanks Lateral portion of the proposed pipeline is located primarily in the ARR transportation corridor. Along this route, the proposed pipeline lateral would transect or be located in proximity to (less than 1 mile) the following recreation features: Goldstream Public Use Area, Tanana Valley State Forest, and Minto Flats State Game Refuge. Additionally, 18 miles of the proposed route would pass through populated areas, and the route would cross (underground) three roads, two of which are crossed at the same locations as two of the railroad crossings. There are six ditch crossings of driveways/trails.

Construction

Construction of the proposed Fairbanks Lateral would be similar to the mainline portion of the pipeline route, including construction methods and measures to minimize impacts on visual resources. Accordingly, the short-term visual impacts during construction for the Fairbanks Lateral would be similar to those described above for the proposed pipeline mainline (moderate to strong visual contrast). Although the Fairbanks Lateral is not located parallel to the Parks Highway, it is located in the ARR transportation corridor and would be visible to passengers with high viewer sensitivity. The ARR carries both freight and passengers, and is a tourist attraction in the summer for passengers to enjoy the Alaskan scenery.

Operations and Maintenance

Operation of the proposed Fairbanks Lateral would be similar to mainline portion of the pipeline route, including operating parameters and measures to minimize impacts on recreation resources, so impacts to visual resources due to operation and maintenance of the Fairbanks Lateral would be similar to those described above for the pipeline mainline. The exception is that there would be no aboveground waterbody crossings and no known significant hill cuts in this section that would create long-term visual contrast. Therefore, visual contrasts in this section are expected to be weak, with low impacts to visual resources.

A few maintenance workers and vehicles would be expected to be present occasionally along the lateral. The visual impact of these workers/vehicles and associated activities are anticipated to be minor, due to their temporary nature and the expectation that their presence would have low visual contrast to other elements of the proposed Project.

Aboveground Facilities

Aboveground facilities would be spaced by design along the length of the proposed pipeline. The MLVs would be placed at a maximum of 20 miles apart for the entire length of the pipeline, and may be above or below ground, with actuators aboveground for those valves located below ground. The aboveground portion of the valves would be approximately 6–8 feet in height and, depending on configuration, 10–12 feet in length.

Aboveground structures would also be located at the northern and southern end points of the proposed route: at the northern starting point there would be a GCF, and at the southern terminus there would be a NGLEP facility. Pig launchers and receivers would be collocated with a GCP, compressor stations, a straddle/off-take facility, and the NGLEP facility at the southern terminus of the pipeline. Table 5.11-2 summarizes the location, existing land use, and land ownership of aboveground facilities. There are 37 locations along the route with aboveground facilities, covering an estimated 89 acres; 74 acres would be occupied by the GCP and NGLEP facilities. An estimated 15 acres along the proposed route would be covered by aboveground facilities, primarily by the compressor station(s) and the straddle and off-take facility. An estimated 0.2 acres of aboveground facilities would be located within a designated state recreation area. Among other factors, visual impacts of these facilities would vary based on proximity to travel corridors and other viewing points, level of screening by surrounding vegetation, adjacent land uses, and size and configuration of the facility.

TABLE 5.11-2 Aboveground Facilities: Location, Existing Land Use, and Land Ownership (Indicators of Visual Sensitivity)

Facility ID Number or Name	Milepost	Acres	Land Cover	Land Ownership	Recreation Area
Gas Conditioning Facility, Compressor, Meter Station, Pig Launcher	0	68.7	Sedge/Herbaceous, Open Water, Emergent Herbaceous Wetland	State	None
Mainline Valve 1	20	0.15	Sedge/Herbaceous	State	None
Mainline Valve 2	40	0.15	Sedge/Herbaceous, Developed Low Intensity	State	None
Mainline Valve 3	80.2	0.15	Sedge/Herbaceous	State	None
Mainline Valve 4	98.6	0.15	Sedge/Herbaceous, Developed Low Intensity	State	None
Mainline Valve 5	133	0.15	Dwarf Shrub, Developed Low Intensity	BLM	None
Mainline Valve 6	149.4	0.15	Sedge/Herbaceous, Developed Low Intensity	BLM	None
Mainline Valve 7	170.6	0.15	Dwarf Shrub, Barren Land	BLM	None
Mainline Valve 8	193.2	0.15	Barren Land	BLM	None
Mainline Valve 9	206.6	0.15	Evergreen Forest, Shrub/Scrub	BLM	None
Compressor Station 1[a] ; Pig Launcher/Receiver[c]	225.1	4.3	Shrub/Scrub	BLM	None
Mainline Valve 10	244.6	0.15	Developed Low Intensity, Shrub/Scrub	State	None
Mainline Valve 11	261.9	0.15	Developed Low Intensity, Shrub/Scrub	BLM	None
Compressor Station 2[a] ; Pig Launcher/Receiver[c]	285.6	4.3	Evergreen Forest, Shrub/Scrub	BLM	None
Mainline Valve 12	304.4	0.15	Shrub/Scrub	BLM	None
Mainline Valve 13	323.6	0.15	Developed Low Intensity, Evergreen Forest	BLM	None
Mainline Valve 14	363.5	0.15	Developed Low Intensity, Deciduous Forest	State	None
Mainline Valve 15	382.4	0.15	Shrub/Scrub, Evergreen Forest	Federal	None
Mainline Valve 16	416.8	0.15	Evergreen Forest	State	None
Mainline Valve 17	434.5	0.15	Shrub/Scrub, Evergreen Forest	State	Minto Flats SGR
CS 3/Straddle and Off-Take Facility Compressor[a, b],	458.1	3.3	Deciduous Forest, Evergreen Forest	State	None

TABLE 5.11-2 Aboveground Facilities: Location, Existing Land Use, and Land Ownership (Indicators of Visual Sensitivity)

Facility ID Number or Name	Milepost	Acres	Land Cover	Land Ownership	Recreation Area
Straddle and Off-Take Facility[b], Meter Station, Pig Launcher					
Mainline Valve 18	472.7	0.15	Developed Low Intensity, Deciduous Forest	State, Private	None
Mainline Valve 19	491.6	0.15	Woody Wetlands	State	None
Mainline Valve 20	511.1	0.15	Shrub/Scrub	State	None
Mainline Valve 21	538.3	0.15	Developed Low Intensity, Barren Land	State	None
Mainline Valve 22	558.2	0.15	Evergreen Forest, Mixed Forest	Native Allotments	None
Mainline Valve 23	587.5	0.15	Developed Low Intensity, Mixed Forest	State	None
Mainline Valve 24	604.8	0.15	Developed Low Intensity, Deciduous Forest	State	None
Mainline Valve 25	622.1	0.15	Mixed Forest	State	Denali SP
Mainline Valve 26	658.7	0.15	Emergent Herbaceous Wetlands, Woody Wetlands, Developed Low Intensity	State, MSB	None
Mainline Valve 27	678.3	0.15	Developed Low Intensity, Deciduous Forest	State	None
Mainline Valve 28	697.5	0.15	Developed Low Intensity	Private	None
Mainline Valve 29	716.9	0.15	Deciduous Forest	State	None
Cook Inlet NGLEP Facility, Meter Station, Pig Receiver	736.4	5.2	Developed Low Intensity, Emergent Herbaceous Wetlands, Evergreen Forest, Mixed Forest	MSB	None
Pig Receiver	FL 34.4	NR[c]	Evergreen Forest	Private	None
Mainline Valve 31	FL NR[c]	0.15			
Mainline Valve 32	FL NR[c]	0.15			

[a] Under the one mainline compressor scenario, the AGDC would install CS 2, under the two mainline compressor station scenario, the AGDC would install 2 compressor stations: CS 1 and CS 3. CS 3 would be collocated with the straddle and off-take facility.

[b] The straddle and off-take facility would contain compressor facilities for the Fairbanks Lateral, regardless of the mainline compressor scenario, as described under footnote a. Under the one mainline compressor scenario, this facility would only contain compressor facilities for the Fairbanks Lateral. Under the 2 mainline compressor station scenario, this facility would contain compressor facilities for both the Fairbanks Lateral and the mainline.

[c]NR = information was not reported by the applicant.

Gas Conditioning Facility

The 68.7 acre GCF, which would include several modular buildings as well as ancillary facilities, would be located near Prudhoe Bay at the northern starting point of the proposed route.

Operation of the proposed facility would result in occasional emissions of stack plumes. Landcover in the area is mostly open water and low herbaceous plants. Users of this area are primarily workers supporting the Prudhoe Bay oil field, but the area does receive limited visitation by tourists, as tours of the oil fields and bay are available to visitors to the region. The built environment at Prudhoe Bay includes existing buildings and oilfield infrastructure, so it is expected that the GCF itself would have a weak visual contrast to the existing industrial environment and activity during both construction and operations, with low short-term and long-term visual impacts. Occasional emissions of stack plumes during operations are expected to have a moderate to low visual impact as viewed from surrounding areas due to the presence of existing facilities.

Compressor Stations

There would be a minimum of one compressor station located at pipeline MP 285.6 or a maximum of two compressor stations located at pipeline MP 225.1 and 458.1.

Construction

Similar to all proposed aboveground facilities, during construction, the presence of construction materials, equipment, workers, and construction activity, would result in bare soil and dust, and would contrast with the primarily natural, vegetated, and uninhabited environment in all three locations, resulting in short-term visual impacts.

Operations and Maintenance

As shown in Figure 2.1-3, Compressor Station 1 would be located at MP 225.1, adjacent to the Dalton Highway, just north of the community of Wiseman along the Koyukuk River, near other built environment features, including the TAPS, a nearby landing strip, and several trails/minor roads. Compressor Station 1 would cover 4.3 acres of shrub/scrub vegetation. The existing infrastructure in the area, with straight horizontal lines and non-vegetated areas, would reduce the visual contrast of the compressor station. However, as the compressor station is located adjacent to the Dalton Highway and is the only building in the immediate area, it is expected that the uniform texture, square form, and straight, vertical and horizontal lines of the building would create moderate to strong visual contrast to the irregular lines, form, and texture of the surrounding vegetation and landforms. Compressor Station 1 is located in the Dalton Highway Utility Corridor, in which visual resources are managed according to Class IV VRM. Class IV VRM guidelines allow the level of change to the characteristic landscape to be high. Therefore, although management guidance requires that attempts be made to minimize visual impacts, Class IV VRM objectives would be met with moderate to strong visual contrast.

As shown in Figure 2.1-4, Compressor Station 2 would be located at MP 285.6 along the Dalton Highway just south of the Prospect Creek Airport near several trails or minor roads. Compressor Station 2 would cover 4.3 acres of scrub/shrub and evergreen forest vegetation. An access road from the Dalton Highway to Compressor Station 2 would be constructed, with the Compressor Station located approximately 2,000 feet from the Dalton Highway. The existing infrastructure in the area, including TAPS, the Prospect Creek airstrip, and the Bettles-Prospect Winter Trail, as well as the Dalton Highway would also reduce the visual contrast of the access road and the facility. The rolling terrain and evergreen forest vegetation in the surrounding area would aid in partially screening the compressor station from the highway and also from afar. Although the compressor station would be the only structure in the immediate area that is potentially visible from the Dalton Highway, it is expected that the visual contrast would be weak to moderate, due to its separation from the Dalton Highway and potential vegetative screening by evergreen forest. Compressor Station 2 is also located in the Dalton Highway Utility Corridor, in which visual resources are managed according to Class IV VRM. Class IV VRM guidelines allow the level of change to the characteristic landscape to be high. Therefore, although management guidance requires that attempts be made to minimize visual impacts, Class IV VRM objectives would be met with moderate to strong visual contrast. The AGDC has stated in their POD that efforts would be made to minimize visual effects, particularly in areas of high scenic and visual value.

As shown in Figure 2.1-5, Compressor Station 3 would be located at MP 458.1 with the Straddle and Off-Take Facility on 3.3 acres just east of Dunbar in deciduous and evergreen forest near Tanana Valley State Forest and Minto Flats State Game Refuge. This facility would be situated at the junction of the mainline and the Fairbanks lateral segments, along the ARR and near the Dunbar-Brooks Terminal Trail. Compressor Station 3 is not adjacent to a highway, and so an access road would be required. While not situated on a highway, the compressor station and its access road would likely be visible to passengers on the ARR as well as recreationists in the area with high viewer sensitivity. Due to the forest vegetation and rolling hills in the area that would screen the facility from afar, it is expected that the facility would be visible for only a short duration to travelers in the area. However, as the only building in the immediate area, it is expected that the uniform texture, square form, and straight, vertical and horizontal lines of the building would create moderate to strong visual contrast to the irregular lines, form, and texture of the surrounding vegetation and landforms. No VRM Class has been established for the lands at Compressor Station 3.

A few maintenance workers and vehicles are expected to be present occasionally at the site. The visual impact of these workers/vehicles and associated activities are anticipated to be minor, due to their temporary nature and the expectation that their presence would have low visual contrast to other elements at the site.

Straddle and Off-Take Facility

As shown in Figure 2.1-5, the proposed straddle and off-take facility would be collocated with Compressor Station 3 at MP 458.1 near Dunbar, and would have the same expected visual impacts. During construction, the presence of construction materials, equipment, workers, and construction activity, with resulting bare soil and dust, would contrast with the primarily natural, vegetated, and uninhabited environment in all three locations, resulting in short-term visual impacts. During operations and maintenance, it is expected that the uniform texture, square form, and straight, vertical and horizontal lines of the building would create moderate to strong visual contrast to the irregular lines, form, and texture of the surrounding vegetation and landforms.

A few maintenance workers and vehicles are expected to be present occasionally at the site during operations and maintenance. The visual impact of these workers/vehicles and associated activities are anticipated to be minor, due to their temporary nature and the expectation that their presence would have low visual contrast to other elements of the proposed Project.

Cook Inlet Natural Gas Liquids Extraction Plant Facility

The proposed Cook Inlet NGLEP Facility would be located at the terminus of the route at MP 736.4 on approximately 5.2 acres in an area surrounded by low intensity development (including agricultural fields), herbaceous wetlands, and evergreen forest. There are several trails in the vicinity, but the facility would not be adjacent to any highways or primary travel routes. The nearest recreation area is the Susitna Flats State Game Refuge, located approximately 1.6 miles away. The rolling terrain and evergreen forest vegetation in the surrounding area would at least partially, if not completely, screen the NGLEP Facility from primary travel routes and residences in the vicinity. Therefore, it is expected that the visual contrast of this facility from primary travel routes would be weak to moderate during both construction and operations and maintenance phases.

Mainline Valves and Pig Launcher/Receivers

Thirty-seven MLVs would be located in numerous locations along the pipeline route at approximately less than 20 mile intervals. All of the proposed pig launcher/receivers would be collocated with other facilities, and would not increase the visual impact associated with those facilities due to their relatively small size. The facilities at the end of the Fairbanks Lateral (MP FL 34.4) would include a pig launcher/receiver, line valve, and ancillary facilities (metering stations). Aboveground components of the mainline valve would include valves and piping, which would be surrounded by 6 foot high security fencing, each covering approximately 0.1 acre. Some of the valves would be located adjacent to a highway travel route, and some would be located in close proximity (less than 1 mile) to several recreation features, including the Denali NPP, Tanana Valley SF, Minto Flats State Game Refuge, and Denali SP. One MLV would be located in Minto Flats State Game Refuge, while another would be located in Denali SP.

Construction

During construction, the presence of construction materials, equipment, workers, and construction activity, with resulting bare soil and dust, would contrast with the primarily natural, vegetated, and uninhabited environment in most mainline valve locations, resulting in short-term visual impacts.

Operations and Maintenance

Visual impacts resulting from the proposed MLVs and pig receiver located in the Fairbanks Lateral would be reduced by restoration of the area with native vegetation. Impacts would vary by location, depending on such factors as the surrounding vegetation and terrain (and associated level of screening from potential viewers), proximity to a major travel corridor or recreation location, and adjacent land uses. MLVs are located in low-intensity developments, open water/herbaceous areas, forested areas, and scrub/shrub areas. Visual impact would tend to be reduced in forested and hillier areas that offer greater screening from travel routes and potential viewers. In areas where the MLVs/pig receiver would be visible, it is expected that the smooth texture and straight, vertical lines, valves, and fencing would create moderate to strong visual contrast to the irregular lines, form, and texture of surrounding vegetation and landforms.

The presence of a few maintenance workers and vehicles at mainline valve and pig launcher/receiver sites would be expected occasionally during operations and maintenance. The visual impact of these workers/vehicles and associated activities are anticipated to be minor, due to their temporary nature and the expectation that their presence would have low visual contrast to other elements of the proposed Project.

Support Facilities

Operations and Maintenance and Logistics/Construction Support Buildings

Three proposed permanent operation and maintenance buildings would be developed and located at the gas conditioning facilities in Fairbanks and Prudhoe Bay and at the Cook Inlet NGLEP Facility. As these buildings would be collocated with these facilities, the same expected impacts would result. During construction, the presence of construction materials, equipment, workers, and construction activity, with resulting bare soil and dust, would contrast with the primarily natural, vegetated, and uninhabited environment in all three locations, resulting in temporary visual impacts. During operations and maintenance, it is expected that the uniform texture, square form, and straight, vertical and horizontal lines of the buildings would create moderate to strong visual contrast to the irregular lines, form, and texture of the surrounding vegetation and landforms. Additional logistics support sites and construction support offices would also be developed; as these offices would be located near a major airport and/or in such developed urban areas as Fairbanks or Seward, the visual contrast from such facilities is expected to be weak, with low visual impact.

Construction Camps, Pipe Storage Yards, Air Facilities, Rail Yards, and Ports

There are a total of 15 proposed stationary construction camps and 26 proposed off-site storage and lay down yards, including 15 that would be located with stationary construction camps. Mobile and stationary construction camps would be constructed along the mainline pipeline, and would include temporary housing. Mobile construction camps would be small, exist for a short duration, and be located in previously disturbed areas used for the construction of the TAPS, ARR facilities, or for public events. Stationary construction camps would house proposed Project personnel, store fuel and equipment, and serve as lay down yards. Stationary camps would house between 250 and 500 workers, and would range in size from 8.5 to 10 acres. Additionally, existing airstrips and port facilities would be used, but some improvements could be required for proposed Project use.

The proposed construction camps and pipeline yards would be located north of MP 708 along the mainline, and would be adjacent (less than 1 mile) to a number of recreation features, including Denali NPP, Tanana Valley SF, Minto Flats State Game Refuge, and Denali SP.

Construction

During construction, the presence of construction materials, equipment, and workers at stationary and mobile construction camps would contrast with the primarily natural, vegetated, and uninhabited environment in most locations along the route, resulting in short-term visual impacts. However, visual impacts would be reduced, as stationary construction sites would be located in previously disturbed areas. Visual impacts of pipe storage yards would contrast with the primarily natural, vegetated environment in most locations along the route, resulting in short-term visual impacts. Construction for proposed Project improvements, as well as increased activity at air facilities, rail yards, and Ports, would result in low visual impacts, as this activity and construction would be generally consistent with the industrial nature of these facilities.

Operations and Maintenance

The construction camps and pipeline yards would not be required during proposed Project operations. Once re-vegetation is complete, little to no visual impacts are expected. Although infrastructure improvements would remain at airport facilities, rail yards, and ports, the number of workers and level of activity would return to baseline conditions.

Material Sites

The proposed Project would require an estimated 13.1 million cubic yards of sand and gravel material, which would be extracted from approximately 546 material sites within 10 miles of the proposed Project. As the specific locations of the material sites are not known, it is not possible to identify the specific visual resource impacts of these sites. However, the AGDC has stated that to the extent possible, it would avoid locating facilities in places with special visual resource values that would be visible to the general public, which would reduce the visual impact of these facilities (AGDC 2011).

Construction

During construction, the presence of construction materials, equipment, workers, and excavation activity, with resulting bare soil and dust, would contrast with the primarily natural, vegetated, and uninhabited environment in most locations along the route, resulting in temporary visual impacts.

Operations and Maintenance

Material sites would cease to be operated by AGDC during the operations and maintenance phase of the proposed Project. Prior to development, the AGDC would develop a Material Site Reclamation Plan. Following reclamation, the visual impact of material sites would be reduced by restoration of the area with native vegetation and re-grading construction disturbances to a condition that blends with the surrounding terrain and surface drainage patterns. Visual impact would vary by location, depending on such factors as the surrounding vegetation and terrain (and associated level of screening from potential viewers), proximity to a major travel corridor or recreation location, and adjacent land uses. Visual impacts would tend to be reduced in forested and hillier areas that offer greater screening from travel routes and potential viewers. In areas where material sites would be visible from travel routes or residential areas, it is expected that despite re-vegetation and re-grading, the form of the terrain would be altered due to material removal, and would likely result in minor to moderate long-term visual impacts.

5.11.2.3 Denali National Park Route Variation

The Denali National Park Route Variation represents an alternate route alignment between MP 540.0 and MP 555.0 (Parks Highway MP 238 and 223) . Although the alignment of this variation would be determined in consultation with Denali NPP, this approximately 15 mile alternative route is expected to parallel the Parks Highway through Denali NPP. It is expected that the route would traverse 6.7 miles of Denali NPP within the Parks Highway ROW. The route separates from the proposed Project north of the Nenana River near MP 540 (Parks Highway MP 238) and crosses the Nenana River just north of the Park entrance on the pedestrian and bicycle bridge. The route crosses under the Parks Highway before and after crossing the Nenana River. The route then rejoins the Parks Highway ROW and enters Denali NPP, where it remains in the Parks Highway ROW for the approximately 7 miles that the route is within the Denali NPP boundary. This route crosses the Nenana River again, buried underground, at the southern section of the route near McKinley Village.

Denali NPP has high recreation and tourist use in the summer months, and such users have high viewer sensitivity. The area also includes developed areas and tourist facilities such as lodging, retail, and food services at McKinley Village near the Park entrance. The land cover in the area along the route includes 7.4 miles in developed areas, 5.4 miles are in forest, 1.1 miles are in scrub/shrub vegetation, and 0.2 mile passes through water/wetland areas.

Construction

Visual contrast during proposed Project construction would result from earthwork, exposure of bare soils due to clearing and removal of existing vegetation in the 100 foot short-term ROW, trenching, the presence of construction workers and vehicles, and the storage of construction materials. This construction materials and activity would contrast visually with the surrounding environment as bare soil is exposed and vegetation removed. Due to the sensitivity of viewers, particularly during the visitor season from May to mid-September, this is expected to result in short-term moderate to high visual impacts visible from the Parks Highway, eastern Park lands, and tourist facilities near the park entrance.

The separate analysis conducted for the AGDC by Design Alaska (2012) assessed visual impact of the Denali National Park Route Variation at two KOPs: Parks Highway at MP 234 (ASAP MP 544) and Mount Healy Overlook Trail (see Appendix K). The analysis identified interim VRM classes in the proposed Project area visible from these KOPs as VRM Class II and Class III, respectively. The Design Alaska analysis conducted visual simulations for both construction and operations phases at both of these KOPs. Visual contrast of the Mount Healy

Overlook Trail KOP is identified as weak, as the pipeline route is seen from a distance and parallels existing linear features including the river and roadways, resulting in weak line and color contrast.

The Design Alaska analysis (2012) evaluated a route alignment located within the Parks Highway ROW. The Design Alaska analysis rates visual impacts as moderate to weak at the Parks Highway at MP 234 KOP (ASAP MP 544). Existing visual resources and simulations of the Denali National Park Route Variation during construction, as viewed from the Parks Highway at MP 234 KOP (ASAP MP 544), are portrayed in Figures 5.11-13 and Figure 5.11-14. The pipeline route parallels the roadway and introduces a defined width of clearing for approximately 15 miles. As shown in Figure 5.11-14, the vegetation directly adjacent to the shoulder will be disturbed during the construction phase for the installation of the buried pipeline, creating a color contrast as seen from this location. The visual corridor along the road will look somewhat unbalanced with the east side of the road cleared and fattened to accept the new buried pipeline.

Source: Design Alaska 2011b.

FIGURE 5.11-13 View of Existing Conditions at Parks Highway MP 234 KOP (ASAP MP 544)

Source: Design Alaska 2012.

FIGURE 5.11-14 Simulation of Parks Highway MP 234 KOP (ASAP MP 544) in Construction Phase

No hill cuts that would substantially modify landscape form are anticipated in this segment. However, an aboveground segment of the pipeline would be located near the park entrance on the pedestrian/bicycle bridge over the Nenana River. Construction activity, including the presence of construction workers and pipeline materials and equipment, would result in short-term visual impacts for users of the pedestrian/bicycle bridge and motorists on the nearby Parks Highway Bridge.

As discussed above for the Consolidated General Management Plan for Denali NPP, incompatible uses in the national park include surface disturbing activities that “unduly change the visual character of the park and preserve” (NPS 2011). The construction activities in the park would occur within the Parks Highway ROW, and visual impacts would be reduced due to the existing infrastructure, vehicles, and activity in the area. While moderate to high visual impacts would likely occur during construction, these short-term impacts would not be expected to unduly change the visual character of the park.

Operations and Maintenance

The permanent ROW in this route would cover 29.2 acres of developed lands, 22.1 acres of forest, 4.1 acres of shrub/scrub, 4.1 acres of barren lands, and 1.1 acres of water/wetland. Because the pipeline would be located underground in the Parks Highway ROW, and the pipeline route would be re-vegetated, long-term visual impacts would be limited. Once construction is complete, it is expected that the aboveground segment of the pipeline at the northern Nenana River crossing would only be visible by travelers on the Nenana River and not those on the Parks Highway or the pedestrian/bicycle bridge. As the pipeline infrastructure is expected to blend with the bridge infrastructure, the long-term visual impacts of this aboveground segment are expected to be low.

With the exception of the aboveground segment near the northern Nenana River crossing, all of the pipeline route would be located underground within the Parks Highway travel corridor, in which disturbed ground would appear similar to existing conditions following re-vegetation. It is thus expected that in areas where the route is in the Parks Highway ROW that the proposed Project would create a weak contrast to the existing landscape form, line, texture, and color, resulting in low visual impacts.

Simulation of the visual impact of the route variation (depicted as within the Parks Highway ROW) as seen from the Parks Highway MP 234 KOP (ASAP MP 544) during operations is shown in Figure 5.11-15 below. Visual contrast from this KOP during operations is expected to be weak as re-vegetation decreases the color contrast.

Source: Design Alaska 2012.

FIGURE 5.11-15 Simulation of Parks Highway MP 234 KOP (ASAP MP 544) in Operations Phase

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5.12 SOCIOECONOMICS

This section describes the baseline socioeconomic conditions in the area that could be affected by the proposed Project and estimates potential socioeconomic effects that could result from proposed Project implementation. Key socioeconomic resources addressed in this section include population, employment, housing, income, tax revenue, property values, and environmental justice. The existing socioeconomic conditions are discussed in Section 5.12.2, Affected Environment, and Section 5.12.3, Environmental Consequences, details the potential effects resulting from proposed Project implementation.

5.12.1 Data and Methodology

The study area for this analysis includes the four Alaskan boroughs and the single census area (CA) traversed by the proposed Project: Denali Borough, Fairbanks North Star Borough (FNSB), Matanuska-Susitna Borough (Mat-Su), North Slope Borough (North Slope), and the Yukon-Koyukuk Census Area (YKCA) (See Figure 5.12-1). In addition to the boroughs described above, the study area for this analysis includes the YKCA portion of the Unorganized Borough. The YKCA is a 148,000 square-mile portion of Alaska's Unorganized Borough, which encompasses nearly 323,400 square miles of the state. This portion of the Unorganized Borough was selected for analysis due to the availability of socioeconomic information and this information is more representative of the area intersected by the proposed Project versus that of the entire Unorganized Borough. For comparison purposes, information is also often presented for the State of Alaska and the United States. The study area for this section is the boroughs and the CA traversed by all alternatives. Both the Denali National Park Route Variation and the proposed action traverse the Denali Borough. Therefore, no discrepancy exists for the baseline socioeconomic conditions for these alternatives. Figure 5.12-1 illustrates the study area as it relates to the socioeconomic analysis.

This section relies on data published by a variety of local, state, and federal sources such as the 2000 Census, the 2010 Census, 2005-2009 American Community Survey (ACS), Alaska Department of Workforce Development, Bureau of Economic Analysis, Bureau of Labor Statistics and the Alaska Department of Commerce, and Community and Economic Development. Data is presented for the four Alaskan boroughs and the CA in the study area, the State of Alaska, and the United States, subject to availability.

In particular, this section uses data from the 2010 Census and 2005-2009 ACS 5-year estimates. While both of these data sources are compiled by the U.S. Census Bureau, there are fundamental differences in the two datasets. The 2010 Census has a much smaller margin of error as it is a survey of 100 percent of the population, while ACS data is an estimate based upon a population sample. The ACS was developed to obtain the same information previously collected on the long-form questionnaire of the 2000 Census, but more frequently than every 10 years. In contrast to previous censuses, the 2010 Census did not collect income and poverty information, so the most recent data for these socioeconomic indicators is from the ACS 2005-2009. All ACS estimates should be interpreted as average values over the designated period (U.S. Census Bureau 2009).

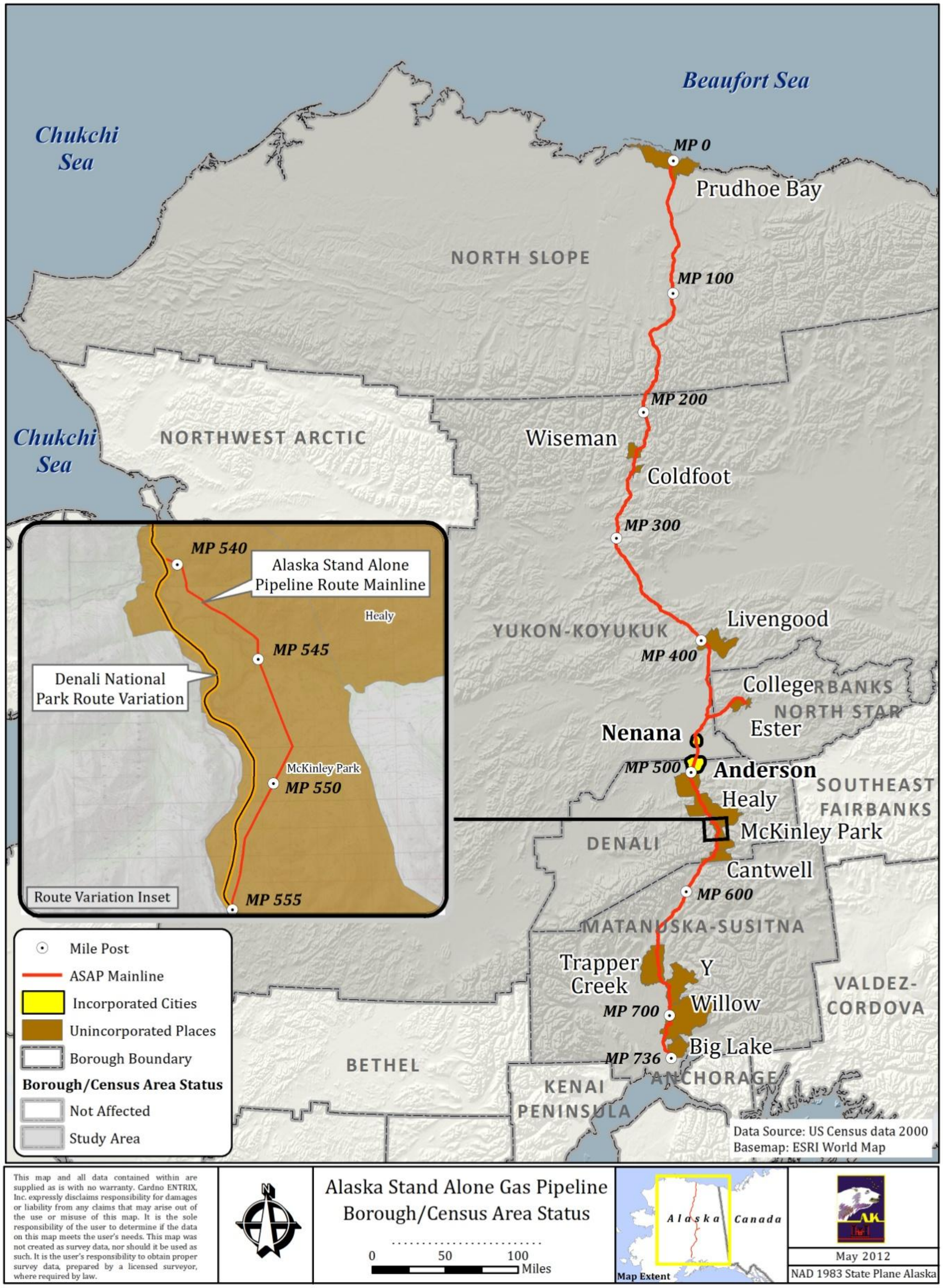


FIGURE 5.12-1 Proposed Project Routes and Affected Boroughs and Census Areas

In accordance with Council on Environmental Quality (CEQ) guidance, (CEQ 1997) minority populations should be identified if the minority population in the proposed Project area "exceeds 50 percent" or if the percentage of minority population in the proposed Project area is meaningfully greater than the "minority population percentage in the general population or other appropriate unit of geographic analysis." The concept of environmental justice is rooted in the Civil Rights Act of 1964, which prohibited discrimination in federally-assisted programs, and in Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*," issued February 11, 1994. Executive Order 12898 was intended to ensure that Federal actions and policies do not result in disproportionately high adverse effects on minority or low-income populations.

The socioeconomic information and other relevant data are used to address environmental justice in compliance with Executive Order 12898. The environmental justice concerns are addressed by determining whether low-income and/or minority populations reside within the proposed Project area and, if present, whether disproportionate social, environmental, economic, and health effects of the proposed Project are anticipated for these populations. Any disproportionately high environmental, socioeconomic, and/or health effects on these groups (relative to total population effects) that are predicted to occur as a consequence of the proposed Project and alternatives are identified and characterized.

5.12.2 Affected Environment

This section has two components: socioeconomics and environmental justice. The socioeconomic analysis describes the existing condition of the area potentially affected by proposed Project development. Data on current population, population projections, employment, unemployment, income, tax revenues, and housing are presented. The environmental justice portion presents more detailed data on race, ethnicity, income levels and poverty rates in the study area. This data is used to determine if there would be disproportionate effects from the proposed Project on minority or low income populations within the study area.

5.12.2.1 Socioeconomics

This section establishes baseline socioeconomic conditions in the study area to provide context for potential socioeconomic effects of the proposed Project. Important population trends, employment, income, unemployment, taxes, housing and tax revenues in the boroughs/CA, state, and nation are highlighted and discussed.

Population Trends and Projections

At 1.2 people per square mile, Alaska has a low population density compared to the United States as a whole, which has an average density of 87.3 people per square mile. While a few boroughs in the study area have higher population densities than Alaska overall, all areas within the study area are relatively sparsely populated when compared to the nation. The current and projected population for the four boroughs and the CA in the study area are summarized in Table 5.12-1.

As indicated in Table 5.12-1, in 2010 the study area had a population of 203,420, an increase of 29 percent from 2000. Nearly 92 percent of this population is located in the FNSB or the Mat-Su. Over the 2000–2010 period, population increases were exhibited in the FNSB (18 percent increase), Mat-Su (50 percent) and the North Slope (28 percent). The Denali Borough and the YKCA experienced 3-percent and 15-percent population decline over the decade. Both the FNSB (13.3 people per square mile) and Mat-Su (3.61 people per square mile) have population densities greater than Alaska statewide, while all others have lower population densities than statewide estimates.

TABLE 5.12-1 Study Area Population

Area	Population		Change (2000-2010)	Percentage Change (2000-2010)	Population Density (2010)
	2000[a]	2010[b]			
Denali Borough	1,890	1,830	-60	-3.17%	0.14
Fairbanks North Star Borough	82,840	97,580	14,740	17.79%	13.25
Matanuska-Susitna Borough	59,320	89,000	29,680	50.03%	3.61
North Slope Borough	7,390	9,430	2,040	27.60%	0.11
Yukon-Koyukuk Census Area	6,550	5,590	-960	-14.66%	0.04
Study Area Total	157,990	203,420	45,430	28.76%	0.73
State of Alaska	626,900	710,200	71,500	11.40%	1.24
U.S.	281,421,900	308,745,500	25,584,700	9.10%	87.28

[a] U.S. Census Bureau 2011a.
[b] U.S. Census Bureau 2010a.

Population projections through 2030 for the study area, Alaska, and the United States are provided in Table 5.12-2. The population in the study area is projected to increase by 37 percent over the 2010–2030 period. In keeping with past trends of population growth in this region, nearly all of this population growth is anticipated to occur in the Mat-Su and FNSB, which are anticipating a population increase of 63 percent and 19 percent respectively. The population in the North Slope is also anticipated to increase by 2030, growing by 2,040 people (22 percent growth), a small component of the total growth within the study area. In contrast, by 2030 the population of the YKCA is anticipated to decline by 13 percent, or 750 people, and the population of the Denali Borough is projected to fall by 14 percent, or 255 people.

At both the state and national level, population is anticipated to increase by 20 percent over the 2010–2030 period. The projected rate of population increase within the study area is approximately double the national and statewide rate of population increase.

TABLE 5.12-2 Population Projections (2010 to 2030)[a]

Area	Population					Change (2010 - 2030)
	2010	2015	2020	2025	2030	
Denali Borough	1,830	1,780	1,710	1,640	1,570	-14.0%
Fairbanks North Star Borough	97,580	102,660	107,150	111,490	115,720	18.6%
Matanuska-Susitna Borough	89,000	103,260	117,670	131,180	145,300	63.3%
North Slope Borough	9,430	9,990	10,470	10,910	11,470	21.6%
Yukon-Koyukuk Census Area	5,590	5,460	5,300	5,080	4,840	-13.4%
Study Area Total	203,430	223,150	242,300	260,300	278,900	37.1%
State of Alaska	710,200	747,260	784,340	819,570	852,670	20.1%
U.S.[b]	308,745,500	323,979,100	339,750,200	355,738,100	371,713,200	20.4%

[a] DOLWD 2007a. Alaska Department of Labor and Workforce Development forecast were updated by applying the DOLWD estimated population growth rates to 2010 Census Bureau population estimates for each of the outlined areas.

[b] U.S. Census Bureau 2010b.

Area Economy

This section describes the economic conditions in the study area, including employment by sector, income, unemployment, housing, and tax revenues.

Employment

Table 5.12-3 presents employment by industry in 2008 for the study area, the state, and the nation. Some areas exhibit a limited number of businesses or limited employment within a sector. Therefore, employment data are not available at the borough or CA level to avoid disclosure of confidential information (presented as (D) or (L) in the table below). Employment by industry indicates the composition and importance of specific industries in the regional economy. In all study area boroughs and the CA, the government sectors provide either the most or second-most jobs when compared to other sectors of the economy. Specifics regarding employment by sector are presented below.

Employment within the study area (Denali, FNSB, Mat-Su, North Slope, and the YKCA) totals 111,795 jobs. Approximately 54 percent of total employment in the study area is within the FNSB. The FNSB is home to two military installations: Fort Wainwright Army Installation and Eielson Air Force Base. Military personnel alone account for 15 percent of the borough’s total employment, while statewide and nationally approximately 6 percent and 1 percent of total employment respectively is military. Furthermore, employment for all government positions in the FNSB accounts for 34 percent of the borough’s total employment.

The Denali Borough economy depends heavily upon the tourist trade, primarily related to Denali National Park. While tourism is not classified as an economic sector, tourist activity can be gauged by examining the size of the accommodation and food services sector. In the Denali Borough, 45 percent of employment, or 1,085 jobs, are in the accommodation and food services sector. Furthermore, in 1980 the National Park Service reported that there were 133 hotel rooms near the park's entrance. By 2000, the number of hotel rooms had increased to approximately 1,800. After accommodation and food services, the second highest number of employees is in the government sector with 16 percent of the borough's total employment. The majority of these government employees are affiliated with the Clear Air Force Station (AFS) located approximately five miles south of Anderson. Clear AFS is a radar surveillance site that tracks ballistic missiles. As of 2009, approximately 100 Air Force National Guard personnel were stationed at the facility. In addition to these uniformed personnel, the Department of Defense employs an additional 250 civilians and private contractors at Clear AFS. Furthermore, there are nearly 80 National Park Service employees located at the Denali National Park (DOLWD 2009).

Although not disclosed by the Bureau of Economic Analysis data presented in Table 5.12-3 below, another important employer for the Denali Borough, is the Usibelli Coal Mine. The company reports its employment at 95 employees (Usibelli Coal Mine Inc. 2010). The Usibelli Coal Mine has been producing coal in the Denali Borough since 1971 (DOLWD 2001).

Approximately 29 percent of employment in the study area is located within the Mat-Su. The Mat-Su has the most diverse economy when compared to the boroughs and the CA in the study area. Retail trade, government, construction, and health care and social assistance sectors each account for between 11 percent and 15 percent of the borough's total employment. The Mat-Su also has a higher concentration of jobs in the construction and retail trade sectors when compared to the state and the nation. Furthermore, the Mat-Su Borough is less reliant on employment in the government sector than elsewhere in the state.

The Mat-Su economy is highly dependent on its proximity to Anchorage. The major reasons for economic growth within the Mat-Su are its competitive housing market and its location relative to the Anchorage labor market (DOLWD 2010a). For example, somewhere between 33% (2005 estimate contained in DOLWD 2007b) and 40% of Mat-Su residents work in Anchorage (Kalytiak, 2012; Walton, Undated). The largest private sector employer within the borough is the Mat-Su Regional Medical Center with between 500 to 749 employees in 2010 (DOLWD 2011a).

The North Slope accounts for 12 percent of the total employment in the study area. Employment in the North Slope is highly concentrated in the mining sector, which accounts for over 60 percent of the borough's jobs. The mining sector is defined by the North America Industrial Classification System (NAICS) as businesses that extract naturally occurring minerals such as coal, ore, petroleum and gases. The majority of North Slope mining jobs are related to the extraction of petroleum. For example, in 2007 approximately 7,540 of the total 8,342 jobs in the mining sector on the North Slope were for oil and gas extraction and support services (DOLWD 2008). The high concentration of mining employment within the North Slope dramatically exceeds statewide concentration of jobs in the mining sector, where total mining employment is four percent of total employment. The largest private sector employer within the North Slope is ASRC Energy Services, accounting for between 2,000 and 2,249 employees in 2010 (DOLWD 2011a). Despite the relatively high number of oil production and support jobs within the North Slope only 8.3 percent of the borough's total private sector jobs were held by borough residents in 2009 (DOLWD 2011b).

The YKCA is located within Interior Alaska and employment within the YKCA is highly concentrated in the government sector, with nearly 50 percent of all jobs in the public sector. The concentration of government jobs in the YKCA is much higher than the statewide concentration of jobs in the government sector (24 percent). The YKCA economy can be classified as a mixed economy because there are three related economies in effect. These economies include the market economy, the transfer economy, and the subsistence economy. In a market economy, residents work for wages or by selling resources. A transfer economy relies upon subsidies from federal and state sources, while a subsistence economy is based upon hunting, fishing and gathering for food (Husky 1992).

Subsistence hunting and fishing are important to YKCA residents (DOLWD 2001). For example, Alaska Department of Fish & Game, Division of Subsistence found that rural interior residents harvested 613 pounds per person of subsistence food annually in 2001. In comparison, Anchorage residents harvested 19 pounds per person that same year (ADF&G 2001). The largest private sector employer in the YKCA is Tanana Chiefs Conference with an estimated 100 to 250 employees (DOLWD 2011a).

The number of jobs created in the study area has outpaced job creation in Alaska and the U.S. As described above, the study area includes Denali, FNSB, Mat-Su, North Slope, and the YKCA.[1]

Figure 5.12-2 highlights the level of historic job creation from 1993 to 2011 within (i) the total study area; (ii) the study area if Anchorage is included; (iii) all of Alaska; and (iv) the U.S. using an index that defines 1993 as the base year with a job level of 100. For example, if jobs increase by 15 percent over 1993 levels, then the index in Figure 5.12-2 for that point in time is 115. The reader should bear in mind that jobs depicted in Fig. 5.12-2 are defined by the place of residence of the workers, rather than the place of employment. And in some of the areas of the study area, particularly Mat-Su, many residents are employed elsewhere. In 2008, for example, it was estimated that 44% of the employed residents of Mat-Su worked in other areas of the state (Metiva and Hanson, 2008).

[1] One of the commenters suggested that the analysis of the study area could be distorted because (as discussed in the main text) a substantial number of Mat-Su residents work in Anchorage. According to the commenter, this suggests that Anchorage should be included in the study area. For this reason Table 5.12-3 and Fig. 5.12-2 were modified to include Anchorage. The major consequence of including Anchorage in the study area is that, by virtue of its large relative population, Anchorage dominates the study area. Anchorage and FNSB together account for approximately 54% of the total Alaska population, so the practical effect of including Anchorage in the study population is to make the study area economic results very similar to Alaska as a whole.

TABLE 5.12-3 Employment by Industry, 2010

	Denali		FNSB		Mat-Su		North Slope		YKCA		Anchorage Municipality		Alaska % of Employment	U.S. % of Employment
	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total		
Total employment	**2,066**	**100.0%**	**58,228**	**100.0%**	**33,337**	**100.0%**	**14,250**	**100.0%**	**3,169**	**100.0%**	**199,532**	**100.0%**	**100.0%**	**100.0%**
Private employment	1,651	79.9%	37,874	65.0%	28,074	84.2%	12,243	85.9%	1,709	53.9%	156,343	78.4%	75.7%	84.3%
Forestry and fishing	(L)	(L)	(D)	(D)	576	1.7%	30	0.2%	84	2.7%	1,288	0.6%	2.6%	0.5%
Mining	95[a]	4.6%	1,621	2.8%	305	0.9%	8,387	58.9%	93	2.9%	3,444	1.7%	3.9%	0.7%
Utilities	(D)	(D)	427	0.7%	169	0.5%	(D)	(D)	35	1.1%	573	0.3%	0.5%	0.3%
Construction	(D)	(D)	3,754	6.4%	3,302	9.9%	(D)	(D)	147	4.6%	12,025	6.0%	5.4%	5.1%
Manufacturing	13	0.6%	905	1.6%	580	1.7%	(D)	(D)	(D)	(D)	2,446	1.2%	3.4%	7.0%
Wholesale trade	(L)	(L)	780	1.3%	223	0.7%	(D)	(D)	13	0.4%	5,228	2.6%	1.6%	3.5%
Retail trade	(D)	(D)	5,751	9.9%	4,819	14.5%	297	2.1%	216	6.8%	20,642	10.3%	9.9%	10.2%
Transportation and warehousing	112	5.4%	2,473	4.2%	1,292	3.9%	242	1.7%	141	4.4%	12,186	6.1%	5.0%	3.2%
Information	(L)	(L)	614	1.1%	735	2.2%	49	0.3%	21	0.7%	4,840	2.4%	1.7%	1.8%
Finance and insurance	(D)	(D)	1,362	2.3%	947	2.8%	325	2.3%	(D)	(D)	7,560	3.8%	3.0%	5.6%
Real estate and rental and leasing	(D)	(D)	1,679	2.9%	1,541	4.6%	61	0.4%	(D)	(D)	7,009	3.5%	3.4%	4.3%
Professional, scientific, and technical services	(D)	(D)	2,777	4.8%	1,743	5.2%	(D)	(D)	(D)	(D)	15,021	7.5%	5.3%	6.7%
Management of companies and enterprises	0	0.0%	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	1,113	0.6%	0.3%	1.2%
Administrative and waste services	(D)	(D)	1,431	2.5%	(D)	(D)	1,130	7.9%	(D)	(D)	9,563	4.8%	3.8%	6.0%
Educational services	(L)	(L)	704	1.2%	608	1.8%	(D)	(D)	36	1.1%	2,443	1.2%	1.2%	2.3%
Health care and social assistance	15	0.7%	5,540	9.5%	4,211	12.6%	(D)	(D)	(D)	(D)	22,073	11.1%	10.4%	11.0%
Arts, entertainment, and recreation	(D)	(D)	1,253	2.2%	995	3.0%	(D)	(D)	(D)	(D)	4,143	2.1%	2.3%	2.2%

TABLE 5.12-3 Employment by Industry, 2010

	Denali		FNSB		Mat-Su		North Slope		YKCA		Anchorage Municipality		Alaska % of Employment	U.S. % of Employment
	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total		
Total employment	**2,066**	**100.0%**	**58,228**	**100.0%**	**33,337**	**100.0%**	**14,250**	**100.0%**	**3,169**	**100.0%**	**199,532**	**100.0%**	**100.0%**	**100.0%**
Accommodation and food services	(D)	(D)	4,008	6.9%	2,439	7.3%	(D)	(D)	(D)	(D)	14,955	7.5%	7.1%	6.9%
Other services, except public administration	34	1.6%	2,440	4.2%	2,313	6.9%	364	2.6%	163	5.1%	9,791	4.9%	4.8%	5.7%
Government and government enterprises	415	20.1%	20,141	34.6%	4,926	14.8%	2,007	14.1%	1,460	46.1%	43,189	21.6%	24.2%	14.2%
Disclosed Total	684	33.1%	57,660	99.0%	31,724	95.2%	12,892	90.5%	2,409	76.0%	199,532	100.0%	100.0%	100.0%

(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.

(L) Less than 10 jobs, but the estimates for this item are included in the totals.

[a] BEA Mining Sector employment data has been supplemented with Usibelli Coal Mine, Inc. employment data in the Denali Borough from 2008.

Source: BEA 2012.

As noted in the June 2007 issue of Alaska Economic Trends (DOLWD 2007b):

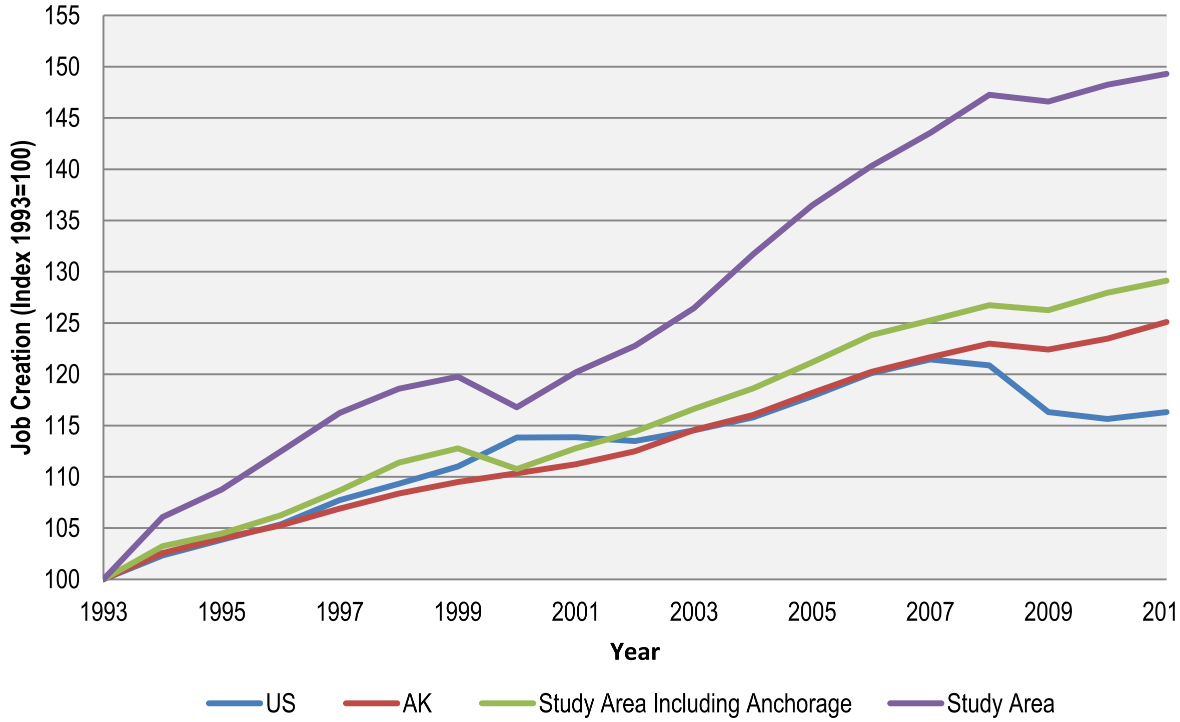
> *During the past four decades, the principal source of the borough's growth has been its proximity to the state's largest city. As already noted, this type of economic relationship is not unusual in other parts of the country, but it's one of a kind in Alaska. What allows this relationship to exist is the fact that most of the Mat-Su Borough's population lives within 40 to 50 miles of Anchorage by a major highway.*
>
> *Simply put, jobs in Anchorage account for much of the borough's growth. Average wages for jobs in Mat-Su are more than a quarter lower than they are in Anchorage. The biggest reason for the wage difference is not that similar jobs pay more in Anchorage, but that Anchorage is home to a much larger number–and percentage–of high wage jobs.*

A 2010 study prepared for the Mat-Su Borough projects that the rate of growth of Mat-Su population will slow over the next 20 years (Mat-Su Borough, 2010).

Referring again to Fig. 5.12-2, note that assuming the study area includes Mat-Su, but not Anchorage, gives the impression that the job growth in the study area is quite high relative to Alaska overall. Assuming alternatively that Anchorage should be included in the study area results in a significantly lower rate of job growth in the study area. From a job growth perspective this latter assumption is arguably more realistic.

Per Capita Income

Table 5.12-4 highlights the annual per capita income characteristics of the study area based on the most recent per capita income data from the 2005-2009 ACS. While annual per capita income has increased since 1999 in the study area, with the exception of the Denali Borough per capita income in the study area is lower than elsewhere in Alaska. The recent rate of per capita income growth in the Denali Borough is much higher than exhibited throughout Alaska and the Nation, likely due to high paying mining jobs within the Denali Borough. All other boroughs saw increases in nominal per capita income, with YKCA and FNSB with the great increases (35 percent and 32 percent, respectively). The Mat-Su and North Slope each exhibited an increase of 18 percent in per capita income.



Source: US Bureau of Labor Statistics 2012. Specifically the Labor Force Statistics including the National Unemployment Rate and the Local Area Unemployment Statistics tools.

FIGURE 5.12-2 Job Creation in Study Area Compared to Alaska and the United States

TABLE 5.12-4 Per Capita Personal Income

Area	1999[a]	2005-2009 Average[b]	Change	Percent Change
Denali Borough	$26,300	$44,700	$18,400	70.0%
Fairbanks North Star Borough	$21,600	$28,400	$6,800	31.5%
Matanuska-Susitna Borough	$21,100	$24,900	$3,800	18.0%
North Slope Borough	$20,500	$24,100	$3,600	17.6%
Yukon-Koyukuk Census Area	$13,700	$18,500	$4,800	35.0%
Alaska	$22,700	$29,400	$6,700	29.5%
U.S.	$21,600	$27,000	$5,400	25.0%

Note: 1999 per capita income is expressed in 1999 dollars (not adjusted for inflation) and 2005-2009 average per capita income is expressed in 2009 dollars.

[a] U.S. Census Bureau 2011b.

[b] U.S. Census Bureau 2010c.

Employment Income

Employment income by industry summarized in Table 5.12-5 is based on 2008 data from the Bureau of Economic Analysis.

As illustrated, compensation per employee within the North Slope is higher in virtually all sectors when compared to the FNSB, YKCA, and the Mat-Su. Generally, this is also the case when examining the statewide income per employee. However, there are a few examples where this is not the case. For example, government income per employee in FNSB and for Denali Borough exceeds the North Slope per employee earnings. The North Slope industry with the highest income per employee is the transportation and warehousing sector with $126,700 per employee. The industry with the highest income per employee in the FNSB is utilities, while government employees in the Mat-Su and Denali Boroughs earn the most relative to other sectors. Heath care employees in the YKCA earn the highest income per employee with a per employee income of $46,000. Statewide, the sector with highest income per employee is mining.

In evaluating the data presented in Table 5.12-4, it is appropriate to note again that the average income in the Mat-Su Borough reflects income earned by residents who commute to higher paying jobs in Anchorage and elsewhere (the North Slope). As noted in the June 2007 issue of Alaska Economic Trends (DOLWD 2007b):

> *Wage data clearly reveal the reason so many Mat-Su residents commute. The commuter work force, which makes up 44 percent of the borough's working population, earns 58 percent of the total wages earned by Mat-Su residents. The workers who earn those wages return home to spend them on housing and consumer goods and services, which spurs additional economic activity in the borough.*
>
> *The degree to which this occurs in Mat-Su is unique in Alaska: the U.S. Bureau of Economic Analysis estimates that more than a third of Mat-Su's $819 million in personal income comes from sources outside the borough. Every other borough and census area in the state has an income flow in the opposite direction – out rather than in.*

Unemployment

The unemployment rate provides insight into the economic health of a region. High unemployment is a sign of an unhealthy economy, which can lead to reduced spending, a decreased tax base, and more unemployment. Alaska has been affected by the recent recession, but its 2010 unemployment rate of 8.0 percent is lower than the national average of 9.6 percent (BLS 2010a). In 2010, Alaska's average unemployment rate was the 19th lowest in the nation (BLS 2010b).

TABLE 5.12-5 Employee Earnings by Industry, 2008[a]

	Denali		FNSB		Mat-Su		North Slope		YKCA		State of Alaska		U.S.	
	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee
Employee Compensation	$114.2	$46,900	$3,063.6	$50,900	$916.5	$28,300	$1,323.8	$95,700	$100.9	$33,800	$21,507	$47,500	$8,048,844	$44,300
Farm compensation	$0.0	$0	$0.6	$2,900	$3.5	$10,600	$0.0	$0	$0.0	$0	$7	$8,900	$26,573	$10,100
Private compensation	$86.3	$42,000	$1,435.5	$36,500	$651.5	$23,600	$1,203.3	$100,300	$35.2	$23,000	$13,838	$40,000	$6,466,975	$41,800
Forestry & fishing	$0.0	(L)	(D)	(D)	(D)	(D)	$0.0	$0	$0.0	$0	$29	$2,500	$16,601	$19,300
Mining	(D)	(D)	$107.6	$57,000	$3.3	$9,700	$953.6	$114,300	$1.6	$20,400	$1,920	$105,900	$71,868	$62,200
Utilities	(D)	(D)	$37.8	$101,000	(D)	(D)	(D)	(D)	$1.1	$32,900	$185	$92,000	$64,932	$109,900
Construction	(D)	(D)	$238.2	$58,500	$111.4	$30,700	$23.4	$86,100	$4.2	$36,400	$1,450	$53,800	$438,833	$39,400
Manufacturing	$0	(L)	$48.3	$46,600	$15.6	$23,700	$0.0	$0	(D)	(D)	$651	$42,100	$937,438	$66,500
Wholesale trade	$0	(L)	$37.5	$48,100	(D)	(D)	(D)	(D)	$0.0	$0	$404	$53,400	$438,191	$66,700
Retail trade	(D)	(D)	$181.2	$28,900	$118.6	$25,000	$10.0	$37,400	$3.7	$16,500	$1,310	$28,400	$502,505	$26,600
Transport & warehousing	$6.5	$22,200	$146.8	$58,500	$35.7	$26,300	$26.2	$126,700	$7.4	$45,800	$1,450	$59,100	$260,780	$43,300
Information	(D)	(D)	$38.0	$52,900	$42.8	$54,800	$3.9	$77,500	$0.4	$23,400	$484	$59,100	$260,909	$73,900
Finance & insurance	(D)	(D)	$56.2	$42,800	$20.8	$24,800	(D)	(D)	(D)	(D)	$703	$55,200	$614,110	$68,100
Real estate	$0.0	(L)	$23.8	$12,600	$6.6	$4,000	(D)	(D)	(D)	(D)	$200	$12,200	$110,390	$13,200
Professional & scientific	(D)	(D)	$72.9	$28,700	$36.0	$21,600	(D)	(D)	(D)	(D)	$996	$41,800	$690,983	$56,000
Management of Co.	$0.0	(L)	(D)	(D)	(D)	(D)	(D)	(D)	$0.0	$0	$116	$83,300	$222,426	$111,600
Administrative	(D)	(D)	(D)	(D)	(D)	(D)	$77.7	$68,400	(D)	(D)	$567	$31,700	$312,123	$28,400
Educational services	$0.0	(L)	$11.3	$16,400	$18.5	$26,500	(D)	(D)	$0.0	$0	$104	$19,600	$129,262	$33,300

TABLE 5.12-5 Employee Earnings by Industry, 2008[a]

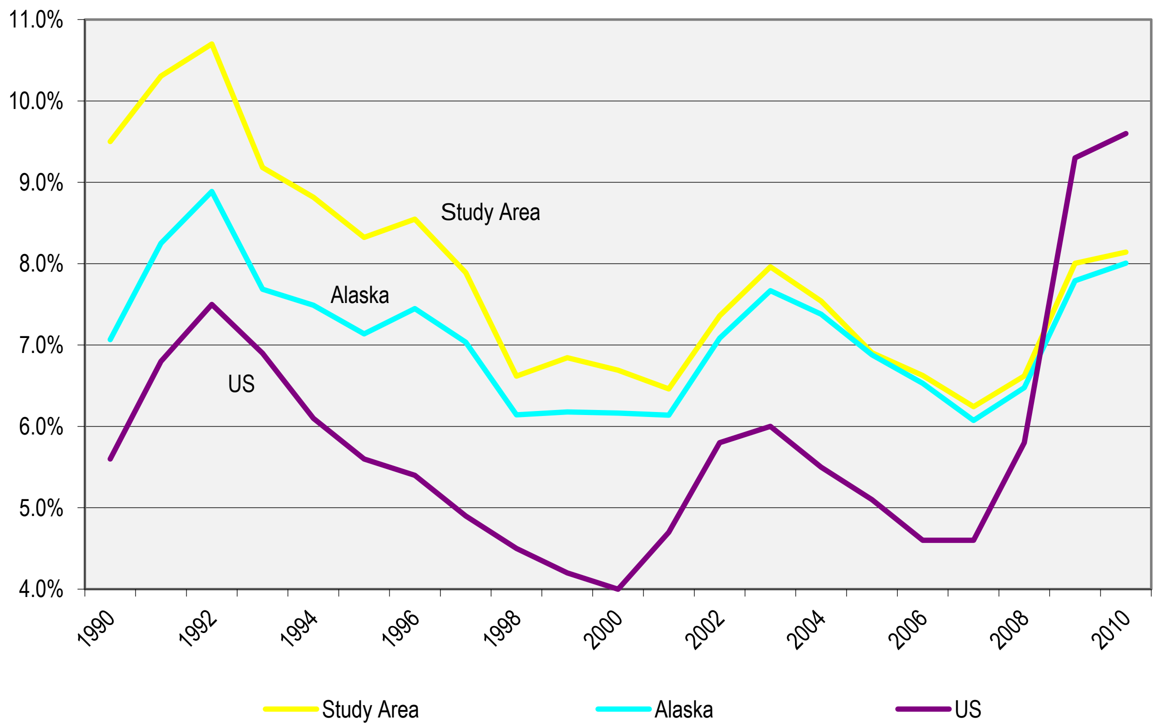
	Denali		FNSB		Mat-Su		North Slope		YKCA		State of Alaska		U.S.	
	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee	Income	Per Employee
Health care	$0.4	$18,200	$224.5	$43,200	$127.4	$35,300	(D)	(D)	$9.6	$46,000	$1,914	$44,200	$821,645	$44,200
Arts & entertainment	$3.1	$30,400	$9.6	$7,300	$8.0	$8,300	(D)	(D)	(D)	(D)	$115	$10,900	$83,484	$21,600
Accommodations	$39.3	$36,200	$92.2	$22,400	$39.9	$16,400	(D)	(D)	(D)	(D)	$739	$22,900	$250,919	$20,400
Other services	(D)	(D)	$52.0	$21,200	$31.0	$14,600	$18.1	$61,800	$3.8	$25,400	$499	$23,200	$239,576	$23,200
Government	$27.9	$73,300	$1,627.5	$78,800	$261.5	$59,000	$120.5	$66,000	$65.7	$45,000	$7,663	$72,100	$1,555,296	$63,300

(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals. (L) Less than 10 jobs for Borough or Census Area within route, but estimates are included in the totals

[a] Income reported in millions of dollars, while income per employee is reported in dollars.

Source: BEA 2010.

The 2010 average unemployment rate for Alaska is nearly 2 percentage points lower than the National rate of 9.6 percent. Figure 5.12-3 presents the unemployment rate for the study area, Alaska, and the United States. Between 1990 and 2008, U.S. unemployment is consistently lower than Alaska and the study areas (see Figure 5.12-3 and Table 5.12-7). In 2009 and 2010, however, Alaska and the study area's unemployment rate are lower than the nation.



Source: DOLWD 2011.

FIGURE 5.12-3 Historic Unemployment Rates

As illustrated in Table 5.12-6, the 10-year average unemployment rate (7.1 percent) for the study area is higher than the statewide average (6.9 percent) and national average (5.9 percent). The only borough or CA to have a lower 10-year average unemployment rate than the statewide rate is the FNSB, with a 6.2 unemployment rate. The YKCA has consistently higher unemployment rates than all other boroughs over the 2000–2010 period, with an average 12.8 percent rate.

TABLE 5.12-6 Unemployment Rates, 2000-2010

	Denali	FNSB	North Slope	Mat-Su	YKCA	Study Area Total	State of Alaska	U.S.
2000	7.1%	6.0%	8.2%	7.1%	11.2%	6.7%	6.2%	4.0%
2001	6.3%	5.8%	7.3%	6.9%	10.6%	6.5%	6.1%	4.7%
2002	7.2%	6.4%	8.4%	8.0%	12.7%	7.4%	7.1%	5.8%
2003	8.6%	6.9%	10.1%	8.6%	13.3%	8.0%	7.7%	6.0%
2004	7.9%	6.4%	10.2%	8.3%	11.9%	7.5%	7.4%	5.5%
2005	6.6%	5.8%	9.0%	7.6%	11.7%	6.9%	6.9%	5.1%
2006	5.7%	5.6%	6.8%	7.4%	13.0%	6.6%	6.5%	4.6%
2007	6.0%	5.4%	5.2%	7.0%	13.4%	6.2%	6.1%	4.6%
2008	5.9%	5.9%	4.1%	7.3%	13.6%	6.6%	6.5%	5.8%
2009	8.3%	7.1%	4.8%	8.9%	14.2%	8.0%	7.8%	9.3%
2010	9.3%	7.1%	5.1%	9.1%	15.4%	8.1%	8.0%	9.6%
Average	7.2%	6.2%	7.2%	7.8%	12.8%	7.1%	6.9%	5.9%

Source: DOLWD 2011.

Housing

Housing for proposed Project labor is important to consider for undertakings where construction is to occur. Specifically, it is important to recognize the existing supply of available homes and if an increased demand for homes within the study area would have implications for the regional housing market. The most recent housing data available is provided by the 2010 Census, while the most recent median household value data available is from the ACS 2005-2009 data.

Table 5.12-7 presents selected home characteristics for those areas within the study area, the state, and the nation. In 2010 data, homes nationwide are 88.6 percent occupied, while statewide 84.1 percent are occupied (U.S. Census Bureau 2010d). The home occupancy rate within the study area (80.2 percent) is lower than the statewide and national occupancy rate.

Within the study area, the Denali Borough and the YKCA have the lowest occupancy rate (45.5 percent and 54.9 percent, respectively), while the FNSB has the highest (87.2 percent) (U.S. Census Bureau 2010d). The North Slope and the Mat-Su both have 18.8 percent and 23.0 percent vacancy rates, respectively. Throughout the entire study area, a total of 19.8 percent of total homes are vacant.

Over the 2005–2009 period, the median value of owner-occupied homes were lower in the study area (ranging from $89,900 in YKCA to $205,000 in Mat-Su) than the median home value in Alaska, $221,300 (U.S. Census Bureau 2010e). The median home value for homes within the North Slope, Denali and FNSB at this time was $143,400, $167,000 and $198,200, respectively. The median home value throughout the U.S. over this same timeframe was $185,400.

TABLE 5.12-7 Select Housing Characteristics, 2010

	Denali	FNSB	Mat-Su	North Slope	YKCA	Study Area Total	State of Alaska	U.S.
Housing Units	1,770	41,780	41,330	2,500	4,040	91,420	307,000	133,341,700
Occupied Housing Units	810	36,440	31,820	2,030	2,220	73,320	258,100	118,092,800
Occupancy Rate	45.5%	87.2%	77.0%	81.2%	54.9%	80.2%	84.1%	88.6%
Vacant	970	5,340	9,510	470	1,820	18,100	48,900	15,248,900
Vacancy (%)	54.5%	12.8%	23.0%	18.8%	45.1%	19.8%	15.9%	11.4%

Note: Totals may not sum due to rounding.

Source: U.S. Census Bureau 2010a.

Tax Revenue

Table 5.12-8 summarizes 2010 municipal (including borough and CA) taxes collected in the municipalities that have taxing authority. Data on state oil and gas tax revenue is also provided in this section.

Statewide a total of $1.4 billion in local taxes were collected in 2010. The boroughs and the CA in the study area collected approximately $487 million in tax revenue in 2010, or 34 percent of total statewide local tax collection. The North Slope collected nearly 56 percent of total local taxes in the study area, while FNSB and Mat-Su collected 21 and 22 percent respectively. Out of the 19 communities traversed by the proposed Project, only Nenana and Anderson levy a tax. The community of Nenana levies a property tax along with a sales tax. The community of Anderson levies an 8-percent utility tax, which generated $34,400 in tax revenues for the community in 2010.

TABLE 5.12-8 Taxable Value, Property Tax, Sales Tax and Other Locally Assessed Tax Revenue, 2010 (millions $)

Municipality	Locally Assessed Value[a]	Local and State Assessed Value	Property Tax Revenues	Oil & Gas Property Tax Revenues	Sales Tax	Other Taxes	Total[c]
Denali Borough	NA	NA	$0.0	$0.0	$0.0	$2.0	$2.0
Fairbanks North Star Borough	$6,794.5	$7,557.9	$87.5	$9.3	$0.0	$4.5	$101.2
Matanuska-Susitna Borough	$7,503.3	$7,588.3	$104.6	$0.1	$0.0	$5.4	$110.1
North Slope Borough	$197.7	$16,447.7	$4.9	$270.8	$0.0	$0.0	$275.7
Nenana	$21.2	$21.2	$0.2	$0.0	$0.2	$0.0	$0.4
Anderson[b]	NA	NA	$0.0	$0.0	$0.0	$0.0	$0.0
Study Area Total	$14,516.7	$31,615.1	$197.20	$280.2	$0.2	$11.9	$489.4
Statewide Local	$61,596.3	$85,632.4	$831.8	$333.9	$193.3	$78.3	$1,437.3

[a] Total assessed value of property for municipalities not imposing a property tax are not included.

[b] Tax revenue generated by the community of Anderson in 2010 ($34,400) is not illustrated because tax revenues are provided in millions of dollars.

[c] Totals may not sum due to rounding.

Source: DCCED 2010.

There are four types of taxes associated with oil and gas production in Alaska: royalties, production tax, corporate income tax, and property tax. In 2010, the State of Alaska received a total of $4.9 billion in oil and gas taxes from these four sources (ADR 2010). Oil and gas production taxes accounted for the largest share of this revenue at $2.9 billion of the total, while royalty payments accounted for $1.5 billion. Oil and gas corporate tax and property taxes contributed $447.9 million and $118.8 million respectively to the state in 2010.

5.12.2.2 Environmental Justice

The U.S. Environmental Protection Agency's (EPA) Office of Environmental Justice provides the following definition of environmental justice:

> *The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies (EPA 2011).*

As previously noted, environmental justice is addressed in the Civil Rights Act of 1964 and Executive Order 12898. Executive Order 12898 requires each federal agency to incorporate environmental justice into its mission by identifying and addressing as appropriate disproportionately high and adverse human health or environmental effects (including social or economic effects) of its programs, policies, and activities implemented both directly and indirectly (for which it provides permitting or funding) on minority populations and low-income populations of the United States (CEQ 1997).

Additional guidance from the President's Council on Environmental Quality clarifies that environmental justice concerns may arise from effects on the natural and physical environment that produce human health or ecological outcomes, or from adverse social or economic changes. Environmental justice issues are mandated and regulated at the federal level, and compliance with NEPA requires analysis of environmental justice effects. The key socioeconomic parameters addressed here for environmental justice are race/ethnicity and measures of social and economic well-being, including per capita income and poverty rates. Environmental justice analysis is performed at the Census Tract (CT) level for CTs traversed by the proposed Project, with borough/CA and statewide totals used for comparison. CTs are small, statistical subdivisions of counties, boroughs or CAs that were created by the U.S. Census Bureau (U.S. Census Bureau 2000). A county, borough, or CA is divided into CTs and each CT usually has between 2,500 and 8,000 residents. CTs provide additional geographic refinement of counties, boroughs or CAs and offer a more site specific approach to analyzing proposed Project implications. When delineated by the U.S. Census Bureau, CTs are designed to be homogeneous to population characteristics, economic status and living conditions. Occasionally, CTs are split due to population growth or combined due to population decline. As provided in Figure 5.12-4, there are 10 CTs within the study area traversed by the proposed Project.

Income-Related Measures of Social Well-Being

As provided in Section 5.14, subsistence is a component of the rural Alaskan economic system and in conjunction with a market economy forms a mixed-economy. Despite this, per capita income, median household income and poverty rates, as presented in Table 5.12-11, are widely used indicators of economic well-being. Poverty rates represent the percentage of an area's total population living at or below the poverty threshold established by the U.S. Census Bureau. Per capita income, median household income, and poverty rates for CTs traversed by the proposed Project are presented in Table 5.12-9.

Many of the CTs in the study area have poverty rates that exceed poverty rates of the state and the respective boroughs in which they are located. For example, three of the four CTs traversed by the proposed route within the Mat-Su Borough have poverty rates ranging from 14.0 to 15.3 percent, which is higher than the overall Mat-Su poverty rate of 10.1 percent and the statewide rate of 9.4 percent. These CTs also have lower median household income compared to the borough and state. The remaining CT in the Mat-Su Borough, CT 600, has more of a mixed picture, with higher median household income and lower poverty rates than the borough and statewide totals, but lower per capita income. The income and poverty comparison in the FNSB is also mixed. The FNSB, CT 1300 exhibits a poverty rate that is higher than the overall borough and statewide poverty rates. Despite this, CT 1300 has higher per capita and household income. Similarly, CT 1900 has a higher poverty rate than that of the borough, but less than overall statewide poverty rate and income within CT 1900 is higher than both the borough and the state.

Measures of income and poverty in the one CT within the Denali Borough (CT 100) indicate greater economic wellbeing than statewide.

Within the North Slope, CT 200 has lower per capita income ($18,500) and median household income ($65,000) than the borough, but higher median household income than the state. At 10.0 percent, the poverty rate is lower than elsewhere in the borough but higher than the statewide average. For the YKCA, CT 200 has greater economic conditions as measured by poverty and per capita income than the borough. The poverty rate within the YKCA's CT 200 (18.7 percent) is higher than the statewide poverty rate (9.4 percent), but lower than the overall poverty rate of the YKCA.

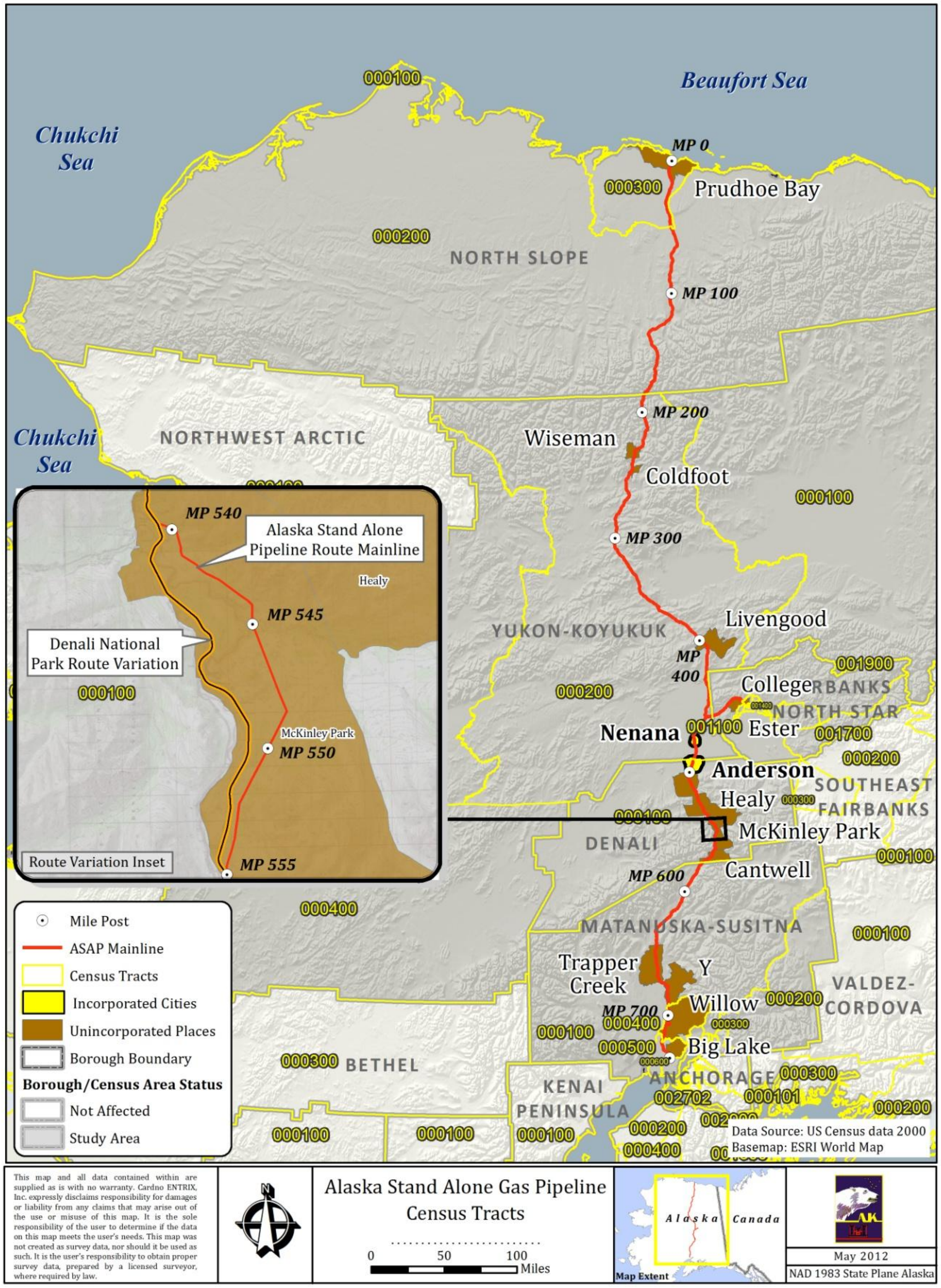


FIGURE 5.12-4 Census Tracts Traversed by the Proposed Project and Denali National Park Route Variation

TABLE 5.12-9 Income and Poverty Rates (2009 dollars)

	Average Per capita income (2005-2009)	Average Median household income in (2005-2009)	Average Poverty Rate (2005-2009)	Percent Difference in Average Poverty Rate Compared to Borough
Denali Borough	$44,700	$76,300	4.4%	0.0%
Census Tract 100	$44,700	$76,300	4.4%	0.0%
Fairbanks North Star Borough	$28,400	$65,100	7.6%	0.0%
Census Tract 1300	$37,400	$72,700	11.3%	48.1%
Census Tract 1900	$31,900	$67,100	9.0%	18.1%
Matanuska-Susitna Borough	$24,900	$66,100	10.1%	0.0%
Census Tract 100	$18,700	$37,200	15.3%	51.0%
Census Tract 400	$24,300	$55,200	13.1%	29.5%
Census Tract 500	$24,900	$62,600	14.0%	38.1%
Census Tract 600	$22,300	$70,100	7.8%	-49.2%
North Slope Borough	$24,100	$66,600	14.7%	0.0%
Census Tract 200	$18,500	$65,400	10.0%	-31.4%
Census Tract 300[a]	-	NA	NA	NA
Yukon-Koyukuk Census Area	$18,500	$33,700	23.8%	0.0%
Census Tract 200	$21,700	$46,100	18.7%	-21.4%
Alaska	$29,400	$64,600	9.4%	NA
U.S.	$27,000	$51,400	13.1%	NA

[a] ACS reports that the 2005-2009 average population of North Slope Census Tract 300 is zero.

Sources: U.S. Census Bureau 2011c, 2011d, 2011e.

Race and Ethnicity

In accordance with the CEQ guidance (CEQ 1997), minority populations should be identified if the minority population in the proposed Project area exceeds 50 percent or if the percentage of minority population in the proposed Project area is meaningfully greater than the "minority population percentage in the general population or other appropriate unit of geographic analysis." For this analysis, the population percentages of the various racial and ethnic groups within the CTs traversed by the alternatives were compared to the borough or CA in which they are located. The CT located within the Denali Borough was compared to the state in order to understand any disproportionate adverse effects of the proposed Project on minorities.

Table 5.12-10 presents the racial and ethnic makeup in the CTs and boroughs/CA traversed by the route alternatives in the State of Alaska and the United States based on 2010 Census data. Statewide, 33 percent of residents belong to a racial minority compared with 28 percent nationwide (U.S. Census Bureau 2010d). The YKCA has the highest percentage of racial minorities out of all boroughs or CA in this analysis, with 78 percent of the total population belonging to a minority group, followed by the North Slope with 67 percent of the population being a minority. The remaining boroughs in this analysis have concentrations of minority populations that are lower than statewide racial minority estimates.

Approximately 5.5 percent of Alaska residents consider themselves Hispanic or Latino, which is higher than all boroughs/CA within this analysis other than the FNSB, with 5.8 percent of the population being Hispanic or Latino. Additionally, 3.3 percent of the state's population identifies itself as black or African American and the FNSB is the only borough/CA with a higher percentage of this population (4.5 percent). Furthermore, approximately 5.4 percent of the state's population is Asian, which is higher than all boroughs and the CA within this analysis. Pacific Islanders make up 1 percent of the state's total population and only the Mat-Su barely exceeds this population concentration.

Statewide, minorities within the "other" category comprise 1.6 percent of the state's total population. In addition, 7.3 percent are multi-race. No boroughs/CA within this analysis have concentrations of other minorities or multi-racial group that exceed the statewide concentrations.

Most of the CTs traversed by the proposed Project have lower proportions of minority populations than the state. Only two CTs have higher rates in any racial group category than the statewide totals: CT 200 in the North Slope Borough is 86.5 percent American Indian or Alaskan Native (AIAN) and CT 200 in the YKCA is 48.8 percent AIAN compared to the statewide percent of 14.8 percent. However, several CTs have a higher percentage of specific minority populations than the boroughs in which they are located. While only one CT in the Mat-Su (CT 600) has a slightly higher concentration of non-white populations than the Mat-Su Borough, three CTs (CT 400, CT 500, and CT 600) have a higher proportion of AIAN populations than the borough. Furthermore, CT 600 has higher concentrations of blacks, AIAN, Asian, Pacific Islanders, multi-racial groups and Hispanics than the Mat-Su overall. Of the two FNSB CTs traversed by the proposed route, only CT 1300 has a higher concentration of a specific minority group than the borough, with 4.1 percent of Asians compared to 2.7 percent in the borough.

As noted above, the North Slope CT 200 has an AIAN population that comprises 87 percent of the total CT, which exceeds both the state and the borough proportion. The other CT in the North Slope Borough traversed by the proposed Project, CT 300, has a higher concentration of blacks (1.9 percent), other races (1.2 percent), and Hispanics (3.7 percent) when compared to the North Slope concentrations of these minorities (but lower than the statewide concentrations). The only CT within the YKCA traversed by the proposed route, CT 200, has higher concentrations of blacks (0.3 percent), other races (1.6 percent) and Hispanics (1.8 percent) when compared to the overall YKCA. However, in each instance these concentrations are slightly higher than the overall YKCA concentrations and lower than the state proportions.

TABLE 5.12-10 Population by Racial and Ethnic Groups

Area	Population			Race			Ethnicity		
	2010	White	Black	AIAN[a]	Asian	Pacific Islander	Other	Multi Race[b]	Hispanic or Latino
Denali Borough	**1,826**	**1,637**	**10**	**65**	**19**	**1**	**14**	**80**	**42**
	100.0%	**89.6%**	**0.5%**	**3.6%**	**1.0%**	**0.1%**	**0.8%**	**4.4%**	**2.3%**
Census Tract 100	1,826	1,637	10	65	19	1	14	80	42
	100.0%	89.6%	0.5%	3.6%	1.0%	0.1%	0.8%	4.4%	2.3%
Fairbanks North Star Borough	**97,581**	**75,175**	**4,423**	**6,879**	**2,591**	**396**	**1,446**	**6,671**	**5,651**
	100.0%	**77.0%**	**4.5%**	**7.0%**	**2.7%**	**0.4%**	**1.5%**	**6.8%**	**5.8%**
Census Tract 1300	6,462	5,358	99	390	262	8	35	310	157
	100.0%	82.9%	1.5%	6.0%	4.1%	0.1%	0.5%	4.8%	2.4%
Census Tract 1900	11,684	10,184	123	510	113	13	85	656	335
	100.0%	87.2%	1.1%	4.4%	1.0%	0.1%	0.7%	5.6%	2.9%
Matanuska-Susitna Borough	**88,995**	**75,540**	**856**	**4,901**	**1,096**	**221**	**640**	**5,741**	**3,301**
	100.0%	**84.9%**	**1.0%**	**5.5%**	**1.2%**	**0.2%**	**0.7%**	**6.5%**	**3.7%**
Census Tract 100	2,801	2,499	10	131	20	4	12	125	55
	100.0%	89.2%	0.4%	4.7%	0.7%	0.1%	0.4%	4.5%	2.0%
Census Tract 400	4,017	3,485	7	235	27	6	26	231	91
	100.0%	86.8%	0.2%	5.9%	0.7%	0.1%	0.6%	5.8%	2.3%
Census Tract 500	3,612	3,093	8	277	22	3	23	186	108
	100.0%	85.6%	0.2%	7.7%	0.6%	0.1%	0.6%	5.1%	3.0%
Census Tract 600	15,346	12,858	174	870	219	57	68	1,100	643
	100.0%	83.8%	1.1%	5.7%	1.4%	0.4%	0.4%	7.2%	4.2%
North Slope Borough	**9,430**	**3,147**	**94**	**5,100**	**425**	**104**	**67**	**493**	**249**
	100.0%	**33.4%**	**1.0%**	**54.1%**	**4.5%**	**1.1%**	**0.7%**	**5.2%**	**2.6%**

TABLE 5.12-10 Population by Racial and Ethnic Groups

	Population			Race			Ethnicity		
Area	**2010**	**White**	**Black**	**AIAN[a]**	**Asian**	**Pacific Islander**	**Other**	**Multi Race[b]**	**Hispanic or Latino**
Census Tract 200	2,690	266	6	2,328	0	2	2	86	25
	100.0%	9.9%	0.2%	86.5%	0.0%	0.1%	0.1%	3.2%	0.9%
Census Tract 300	2,527	2,168	47	195	41	3	31	42	93
	100.0%	85.8%	1.9%	7.7%	1.6%	0.1%	1.2%	1.7%	3.7%
Yukon-Koyukuk Census Area	**5,588**	**1,243**	**10**	**3,992**	**14**	**6**	**9**	**314**	**66**
	100.0%	**22.2%**	**0.2%**	**71.4%**	**0.3%**	**0.1%**	**0.2%**	**5.6%**	**1.2%**
Census Tract 200	1,461	640	5	713	4	0	4	95	27
	100.0%	43.8%	0.3%	48.8%	0.3%	0.0%	0.3%	6.5%	1.8%
Alaska	**710,231**	**473,576**	**23,263**	**104,871**	**38,135**	**7,409**	**11,102**	**51,875**	**39,249**
	100.0%	**66.7%**	**3.3%**	**14.8%**	**5.4%**	**1.0%**	**1.6%**	**7.3%**	**5.5%**
U.S.	**308,745,538**	**223,553,265**	**38,929,319**	**2,932,248**	**14,674,252**	**540,013**	**19,107,368**	**9,009,073**	**50,477,594**
	100.0%	**72.4%**	**12.6%**	**0.9%**	**4.8%**	**0.2%**	**6.2%**	**2.9%**	**16.3%**

[a] AIAN - American Indian and Alaska Native.

[b] Multi race may belong to any race.

Source: U.S. Census Bureau 2011f.

Environmental Justice Summary

In summary, two CTs traversed by the proposed route have minority populations in excess of or near 50 percent. Specifically, North Slope CT 200 and YKCA CT 200 have a high concentration of AIAN population, 86.5 percent, and 48.8 percent respectively. These are the only CTs in which the concentration of a minority group exceeds the statewide average and the only CTs with a minority population exceeding 50 percent.

Of the 10 CTs traversed by the proposed route, all but three have higher poverty rates than the statewide average. Poverty rates in the YKCA and the North Slope are much higher when compared to the state, with 23.8 and 14.4 percent of the population impoverished respectively. While higher than statewide averages, poverty rates for those CTs traversed by the proposed route within the North Slope and the YKCA do not exceed the overall poverty rates within their respective borough or CA.

Five of the CTs have higher poverty rates than the borough in which they are located. Each of the CTs traversed within the FNSB (CT 1300 and CT 1900) has a higher poverty rate than the FNSB overall poverty rate. Similarly, three CTs traversed by the proposed route within the Mat-Su (CT 100, CT 400, CT 500) have poverty rates that are higher than the overall Mat-Su poverty rate.

5.12.3 Environmental Consequences

The proposed Project is expected to affect socioeconomic conditions in the study area, defined as the boroughs and CA in which the proposed Project would be located. This section describes the expected effects of the proposed Project on the following types of socioeconomic resources within the boroughs/CA traversed by the proposed Project: employment, housing, population, property values, taxes, overall quality of life (based on effects in other resource areas such as recreation, air, noise, water, wildlife, etc.) and environmental justice. As provided in Section 4.6, multiple alternatives were considered, but were not carried forward for detailed analysis because they do not meet the objectives of the proposed Project's purpose and need. However, two alternatives and one route variation have been selected for further analysis: the No Action Alternative, the proposed action Alternative, and the Denali National Park Route Variation.

This section analyzes impacts on employment, housing, property values, and taxes at the borough/CA level, and evaluates environmental justice at the CT level.

5.12.3.1 No Action Alternative

If the proposed action Alternative were not to occur there would be no anticipated effects on employment, housing, property values, tax revenues and disadvantaged population within the boroughs/CA. Employment, income, and municipal tax revenue would not increase if the Propose Action Alternative were to not occur. Furthermore, energy costs would not be alleviated if additional natural gas supplies were not made available. Existing socioeconomic conditions are expected to continue along current trend lines.

5.12.3.2 Proposed Action

This subsection provides analysis of socioeconomic effects by facility or development type, including the mainline, Fairbanks lateral, above ground facilities, and support facilities. The duration of the construction phase of the proposed Project is considered to be short-term (2016-2019), and the operation and maintenance phase of the proposed Project is considered long-term (30 years). Employment estimates for construction and operation of each facility type are presented based upon available information provided by the AGDC supplemented with estimates based on other natural gas pipeline projects. Housing and property value impacts are estimated for each facility type based on the change in population and associated housing demand due to the proposed Project, as well as impacts to area amenities or visual impacts as described in the Visual Resources and Recreation sections. Fiscal impacts to municipalities related to bed tax revenues and property taxes are estimated for each facility type based on the number of temporary construction workers and expected value of proposed Project infrastructure for each taxing jurisdiction respectively. The development of a pipeline and supporting facilities would create taxable property and therefore increase the value of this type of property for the State of Alaska and for jurisdictions with these developments. It is assumed that the cost of construction is a good approximation for initial value (with expected lower values in later years due to depreciation). In addition to property taxes, the State of Alaska would also levy natural gas production taxes, royalties for lease of mineral rights, and corporate income taxes based on total proposed Project values. Rather than providing detail on the statewide tax implications of the proposed action by facility or development type, the statewide tax implications for the proposed action are provided in the relevant summary in Section 5.12.3.2.

The anticipated $8.4 billion expenditure for total proposed Project development includes expenditures by the AGDC for both labor and materials. It is unknown how much of this total expenditure would be for materials provided by businesses located within the study area. In general, is it anticipated that materials and equipment would be transported by barge or ship from outside of the study area to an Alaskan port then transferred by rail to Fairbanks (AGDC 2011a). Despite this, those firms that provide goods and services for the proposed action within the study area would benefit from proposed Project development in the form of additional revenue. Furthermore, some construction workers would spend a portion of their income at hotels, RV parks, restaurants and grocery stores, which would support additional revenue for these businesses. Construction employee retail expenditures are discussed by facility development below.

Other socioeconomic and quality of life impacts based on the effects of other resource areas, such as air and water quality, recreation, subsistence, health and public safety, and visual resources are also discussed for the entire proposed Project in the summary section (see Section 5.12.3.2). Finally, environmental justice impacts are estimated for the proposed Project as a whole and not for each facility type.

Pipeline Facilities

<u>Mainline</u>

Construction

The primary socioeconomic impacts of pipeline mainline construction would be on increased employment throughout the study area, and increased tax revenues within the study area.

Employment

The AGDC provided preliminary estimates of pipeline construction labor by construction season over a 3-year period. As illustrated in Table 5.12-11 below, the AGDC provided employment estimates for the eight construction seasons for which pipeline construction would occur. The greatest number of pipeline construction employees is anticipated during the summer of 2017, when 5,500 pipeline construction workers would be in the field. The lowest seasonal employment estimate is anticipated for the fall of 2018 where 100 employees are estimated to be in the field. The AGDC anticipates that the construction season would extend into 2019 for some proposed Project components. However, employment estimates for mainline construction during the 2019 construction season is currently not available.

TABLE 5.12-11 Proposed Project Mainline Construction Employment

Season	Summer 2016	Fall 2016	Winter 2017	Summer 2017	Fall 2017	Winter 2018	Summer 2018	Fall 2018
Pipeline Employees	2,500	1,150	3,200	5,500	2,200	3,800	2,200	100

Source: Norton, Pers. Comm. 2011.

Population and Housing

Non-resident construction workers would temporarily increase the population in the study area, which might be particularly noticeable in low population density areas in the YKCA, Denali and North Slope Boroughs. Given the extreme remoteness of the areas traversed by the proposed action, it is anticipated that most of the mainline construction workers would live in work camps (when at work) and travel to and from these camps primarily using air or bus transportation to either Fairbanks or Anchorage. Specifically, lodging needs for construction of the mainline from MP 0 (Prudhoe Bay) to MP 708 (Willow) would be located in worker camps developed by the AGDC. The provision of housing by the AGDC signifies that the proposed Project would not likely affect the demand for housing in areas surrounding these pipeline segments.

Furthermore, the visual and recreation impacts described in other sections would be temporary in nature, and no long-term effects on property values due to the proposed Project construction phase are anticipated. Table 5.12-12 below presents the housing capacity for the planned work camps.

TABLE 5.12-12 Proposed Project Work Camp Housing

Borough	Location	Camp Capacity	Camp Staff	Borough Total[a]
North Slope	Prudhoe Bay	NA	NA	200
	Franklin Bluffs	500	44	
	Happy Valley	500	44	
	Galbraith Lake	500	44	
	Atigun	250	21	
	Chandler	500	44	
Yukon-Koyukuk	Coldfoot	500	44	220
	Old Man	500	44	
	Seven Mile	500	44	
	Livengood	500	44	
	Nenana	500	44	
Denali	Healy	500	44	90
	Cantwell	500	44	
Mat-Su	Chulitna Butte	500	44	90
	Sunshine	500	44	
Total		6,750	593	590

[a] Totals may not sum due to rounding.
Source: AGDC 2011b.

The AGDC anticipates that the final 64 miles of the mainline would require nearly 1,200 employees to complete. This equates to roughly 19 employees per mile for this segment or approximately 545 construction workers would be required to complete the final 29 miles of the mainline (from MP 708 to MP 737). It is anticipated that these 545 construction employees would reside in local lodging in the vicinity of Wasilla. It is unknown how many of these construction workers would be existing Mat-Su residents. It is expected that non-resident workers would reside for the duration of the proposed Project construction in the hotel and RV Park options available in the greater Wasilla area. Depending on the time of year of construction, this could decrease the availability of such lodging options for recreationists/tourists but would have little to no expected effect on the housing market.

The construction of the mainline would not be within 100 feet of any existing building with exception of one building located within the right-of-way (ROW) between MP 707 and MP 708. The AGDC would be required to purchase private property, including buildings, and compensate private property owners for easements upon their property.

At present there are too many unknowns to provide an accurate estimate of the fraction of the pipeline construction workers who would be Alaska residents.

The percentage of potential pipeline workers who are Alaska residents depends upon several factors including:

- Economic opportunities in Alaska compared to other States: Table 5.12-6 and Fig. 5.12-3 show historical unemployment data for Alaska and the Nation overall. For the years after 2000 until 2009, Alaska's unemployment was higher than the US as a whole[2]—presumably part of the basis for the Commissioner of Labor and Workforce Development's determining the State of Alaska to be a "Zone of Underemployment, triggering certain employment preference requirements.[3] However, since 2009 the unemployment rate for Alaska has been lower than the US overall. Projections by the Alaska Department of Labor and Workforce Development[4] indicate that over the period from 2008 and 2018 Alaska is projected to recover from the aftermath of the recent recession and add 33,670 jobs, an increase of 10.5% (11.3% for construction), compared to a 10.1% gain for the US as a whole. These projections suggest that there would be an economic incentive for nonresidents to seek employment in Alaska in the future. Recent experience in forecasting job growth and unemployment in the United States underscores the fact that these forecasts can be inaccurate.[5]
- Legislative and administrative actions: Clause 30 (Local Hire) of the right-of-way lease for ASAP notes that "The Lessee shall, in the Construction and Operation of the Pipeline, comply with, and require its Contractors to comply with, applicable and valid laws and regulations regarding the hiring of residents of the State then in effect or that take effect subsequently." The State of Alaska closely monitors nonresidents working in Alaska and issues annual reports.[6] Maximizing resident hire continues to be a high priority of the Alaska Department of Labor and Workforce Development. Industries and occupations with high percentages of nonresident workers have been given high priority for new training dollars. Initiatives designed to increase opportunities for residents include employment training, education, and regulatory enforcement. In 2010 approximately 19.6% of workers employed in Alaska were nonresident (DOLWD 2012b). But the percentages in some sectors, such as oil and gas (30.6%) were higher. The 2010 Nonresidents Working in Alaska report (issued in January 2012) prepared an extensive table of the percentages of nonresident workers (by job type) for gasline related occupations (DOLWD, 2012b). It is uncertain what incentives or regulations on resident hire would be in place when the ASAP project would be initiated.
- The specific work rotation schedule: There is anecdotal information that supports the hypothesis that the specific work rotation schedule has an impact on residency decisions of workers. Work cycles of one week on followed by a period of leave, for

[2] See DOLWD 2012a
[3] See DOLWD 2011c. The determination became effective on 1 July 2011 and remains in effect until 30 June 2013. As a result of this determination contractors working on public works contracts throughout the state in certain construction occupations are required to comply with a minimum 90% Alaska resident hire preference unless a waiver is issued.
[4] See DOLWD 2010b..
[5] For one analysis that indicates that employment forecasts are less reliable during periods of recession, see Federal Reserve Bank of St. Louis 2009..
[6] See e.g., DOLWD, 2012b.

example, tend to encourage local residency because the annual cost of air transportation out of Alaska would be relatively high. Alternatively, a 4-week cycle would reduce the potential annual trips substantially and potentially encourage workers to maintain out of state residency.[7] The work rotation schedule for ASAP has not yet been determined.

The above factors indicate why it is difficult to forecast the percentage of ASAP construction workers who would be Alaska residents. If nonresident employment for the proposed project was approximately the same as the rest of the oil and gas sector, then approximately 30% of the workers would be nonresidents.

Tax Revenue

Construction worker housing in hotels and RV parks would be expected to increase local tax revenue in the Mat-Su and Denali Boroughs. The Mat-Su Borough levies a 5-percent bed tax on hotel rooms, while the Denali Borough imposes a 7-percent bed tax on hotel rooms and RV park spaces.[8] Total bed tax revenues would depend on the number of non-resident construction workers (see above) as well as the duration of the construction period. Property tax effects are discussed in mainline operations below.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: (the Applicant's Preferred Option) construct a new aerial suspension bridge across the Yukon River; (Option 2) cross the Yukon River by attaching the pipeline to the existing E.L. Patton Bridge; or (Option 3) utilize the horizontal directional drilling (HDD) method to cross underneath the Yukon River at the location of the proposed suspension bridge. The existing highway bridge is located approximately one half mile east of the proposed location for the pipeline suspension bridge. The impacts to socioeconomics resulting from use of the existing bridge would be similar to those of the proposed pipeline suspension bridge and would be negligible. The feasibility of a HDD crossing is unknown at this time due to limited soils information. The impacts to socioeconomics resulting from the use of the HDD method to cross the Yukon River would be similar to those of the proposed pipeline suspension bridge and would be negligible. The impacts to socioeconomics that would result from the mainline which includes the Yukon River crossing increment are discussed in the mainline section above.

[7] Extended work schedules also have a potential impact on safety as discussed in Parkes 2007 and contained references.

[8] One commenter asked whether or not the work camps would be subject to a bed tax. The answer to this question depends upon the specific tax laws (scope and exemptions) in effect at the time. For applicable laws relating to municipal taxation, see Alaska Statutes Title 29, Chapter 45. Applicable municipal and state laws vary by municipality. For example, in Florida (see Florida Department of Revenue 2009) rentals of living accommodations in migrant work camps are not subject to a tax.

Operations and Maintenance

Employment

It is assumed that pipeline operations and maintenance (O&M) would be performed by O&M facility personnel, who are discussed below in the O&M facilities section.

Housing

Personnel located in Wasilla would be responsible for providing their own housing. Off-site housing would be provided for Prudhoe Bay O&M facility workers, likely at a commercial camp located within Deadhorse. If these workers are new residents to these areas, population would slightly rise, with little effect on local housing conditions or demand. Furthermore, the long-term visual and recreation impacts of the mainline are anticipated to be minor in nearly all areas as it is a buried pipeline. As provided in Section 5.11.2.2, it is expected that areas in which the route is in the Parks Highway ROW that the proposed Project would create weak visual contrast to existing landscape form, line, texture, and color, resulting in low visual impacts. Additionally, as provided in Section 5.10.2.2, proposed Project operations would not result in the long-term conversion of the pipeline corridor to non-recreation uses. Previous research indicates that there would be no discernible and significant impact on the sales price and value of properties located along natural gas pipelines (INGAA Foundation 2001, PGP Valuation 2008). Therefore, little to no long-term effect on private property values due to the proposed Project is anticipated.

Tax Revenue

Construction costs for the pipeline are estimated at $4.4 billion. Upon proposed Project completion, it is assumed that the pipeline mainline would increase total assessed property value by the construction cost, and thereby increase property tax revenue for the state as well as those local jurisdictions that levy property taxes. Assessed value in each jurisdiction was estimated based on the average per mile construction costs for the total 770-mile pipeline (including mainline and laterals) and the length of pipeline located within each borough/CA and municipality.

Initial local property tax revenues from the mainline pipeline are estimated at $23.1 million annually, with $11.8 million to the North Slope, $9.1 million to Mat Su, $1.9 million to FNSB, and $160,000 to the community of Nenana (see Section 5.12.3.3 below for a summary of property tax methodology). Property tax values are expected to decline over time as the pipeline infrastructure depreciates.

Fairbanks Lateral

Construction

Employment

The AGDC anticipates that approximately 800 employees would be required to construct the Fairbanks Lateral. Table 5.12-13 provides the estimated number of workers required to complete the Fairbanks Lateral portions located within the FNSB and the YKCA. As provided, it is anticipated that nearly 110 workers would be required to complete the YKCA portion of the

Fairbanks Lateral, while approximately 690 workers would be necessary to complete the FNSB portion of the Fairbanks Lateral component.

TABLE 5.12-13 Fairbanks Lateral Construction Employment

Borough	Segment	Section	Location	Length (miles)	Borough Total
Fairbanks North Star	Fairbanks Lateral	FL	Mainline to Fairbanks	29.66	110
Yukon-Koyukuk	Fairbanks Lateral	FL	Mainline to Fairbanks	4.76	690
Total					800

Note: Total may not sum due to rounding.
Source: AGDC 2011b.

Population and Housing

It is anticipated that workers constructing the Fairbanks Lateral within the FNSB portion and the YKCA portion would reside in the Fairbanks area and find their own housing. Therefore, there would be a maximum of 800 workers requiring accommodations in the vicinity of Fairbanks. This is the maximum increase in population and housing demand as an unknown number of these workers could be existing FNSB residents. With approximately 5,340 vacant homes and multiple RV parks and hotel options in or near Fairbanks, existing housing availability in FNSB would be expected to meet the needs of proposed Project workers. Depending on the time of year of construction, this could decrease the availability of such lodging options for recreationists/tourists but would have little to no expected effect on the housing market. Furthermore, the visual and recreation impacts of constructing the Fairbanks Lateral are temporary in nature (as described in other sections). Therefore, no long-term effects on property values due to the proposed Project construction phase are anticipated.

Tax Revenue

The FNSB and the City of Fairbanks implement an 8-percent bed tax on hotel and motel rooms, so the increased hotel occupancy from construction workers would increase tax revenue for both the FNSB and the City of Fairbanks. Total bed tax revenues would depend on the number of non-resident construction workers as well as the duration of the construction period. Property tax effects are discussed in Fairbanks Lateral operations below. There are no expected tax implications for the YKCA given that it does not have taxing authority.

Operations and Maintenance

Employment

It is assumed that pipeline operations and maintenance would be performed by the Fairbanks O&M facility personnel, who are discussed below in the O&M facilities section (see Section 5.12.3.1). The AGDC anticipates that there would be a total of 10 full-time operations and maintenance employees for the Fairbanks O&M facility.

Population and Housing

Personnel located in Fairbanks would be responsible for providing their own housing. If these workers are new residents to the area, population would slightly rise, with little effect on local housing conditions or demand. Furthermore, the long-term visual and recreation impacts of the Fairbanks Lateral are anticipated to be minor in nearly all areas as it is a buried pipeline. Other possible factors that could affect private property values are related to the anxiety of a catastrophic event. As provided in Table 5.15-24 of the Public Health section, the operation of the proposed Project could increase resident anxiety during this phase and subsequently could affect private property values. There are approximately 0.5 mile of private property traversed by the Fairbanks Lateral and there are no homes within 100 feet of this segment. The AGDC would be required to purchase private property and compensate private property owners for easements upon their property. Previous research indicates that there is no discernible and significant impact on the sales price and value of properties located along natural gas pipelines (INGAA Foundation 2001, PGP Valuation 2008). Therefore, little to no long-term effect on private property values related to the Fairbanks Lateral is anticipated.

Tax Revenue

The development of the 34.4-mile Fairbanks Lateral is anticipated to create an additional $196.4 million of pipeline transportation property within both the YKCA and FNSB, generating property tax revenue of up to $1.9 million within the FNSB annually (see Table 5.12-18).

Aboveground Facilities

Gas Conditioning Facility

Construction

Employment

The AGDC estimates that the average direct construction labor required for the gas conditioning facility (GCF) to be 250 personnel over the 2016–2019 period (AGDC 2011c).

Population and Housing

Construction of the GCF would result in a temporary increase in the Deadhorse population by 250 people over the 2016–2019 period. It is expected that housing for these construction employees would be provided by the AGDC, most likely in Deadhorse. Therefore, it is anticipated that these construction workers would have little to no impact on existing housing availability or cost within the area.

Tax Revenue

No fiscal revenue impacts would be expected from GCF construction.

Operations and Maintenance

Employment

The AGDC anticipates that the GCF and the Prudhoe Bay O&M facility would require a total of 10 operational employees.

Population and Housing

It is expected that housing for these ten GCF and O&M employees would be provided by the AGDC, most likely in Deadhorse. Therefore, it is anticipated that these workers would have little to no impact on existing housing availability or cost within the area.

Tax Revenue

It is assumed that the initial assessed property value of the GCF facility would be equivalent to the total construction cost, or $4.0 billion. Over the duration of GCF operations, the North Slope would receive estimated property taxes of up to $44.2 million annually due to the facility (see Table 5.12-18).

Compressor Stations

Construction

Employment

Similar to the GCF facility, employment estimates for compressor station construction were provided by the AGDC. It is estimated that there would be a total of 50 construction employees for each compressor station constructed over the 2016–2019 period (AGDC 2011c).

The AGDC is currently evaluating two scenarios for compressor construction. One scenario assumes the construction of one compressor station at MP 285.6, and the second scenario assumes the construction of two compressor stations located at MP 225.1 and MP 466.2. Therefore, total compressor construction employment is estimated to range from 50 (low end of construction employment at one compressor station) to 100 (high end of construction employment at two compressor stations).

Population and Housing

Under the one compressor station scenario, it is expected that 50 compressor station construction workers would reside in the Old Man work camp located at MP 313. If two compressor stations are constructed, it is expected that the 50 workers constructing the compressor station at MP 225.1 would reside at the Coldfoot work camp at MP 247, while another 50 construction workers for the compressor station located at MP 466.2 would reside at the Nenana work camp at MP 476. As the AGDC is expected to provide housing, it is anticipated that compressor construction workers would have little to no impact on existing housing availability or cost within the area. Furthermore, there is little private land located in close proximity to the compressor facility sites, so little to no long-term effect on private property values is anticipated.

Tax Revenue

No revenue impacts from bed taxes are anticipated as construction workers would be housed at work camps and not in local hotels or other accommodations.

Operations and Maintenance

Employment

The AGDC estimates that O&M employment for the compressor station(s) and the Straddle and Off-Take facility could be up to 25 employees (AGDC 2011d).

Population and Housing

With the potential for up to 25 O&M employees, the population impact of the compressor station(s) is negligible. Regarding housing for these workers, the AGDC anticipates that each compressor station would have sleeping quarters, kitchens, showers, restrooms and other amenities. As the AGDC is expected to provide housing, it is anticipated that compressor construction workers would have little to no impact on existing housing availability or cost within the area. Furthermore, there are few private lands located in close proximity to the compressor facility sites, so little to no long-term effect on private property values is anticipated.

Tax Revenue

The compressor station(s) would increase the total assessed property value in the state and local jurisdictions in which the compressors are located. Despite this, the proposed location for these facilities is within the YKCA, which does not levy property taxes. However, the state taxes gas transportation property at a rate of 20 mills, so for every $100 million in value, $2.0 million in state property taxes are received.

Straddle and Off-Take Facility

Construction

Employment

Employment for Straddle and Off-Take facility construction is estimated by the AGDC to be 50 personnel over the 2016–2019 period (AGDC 2011c).

Population and Housing

It is anticipated that construction workers for the Straddle and Off-Take facility located at MP 466.2 would reside at the Nenana work camp at MP 476. As the AGDC is expected to provide housing, it is anticipated that Straddle and Off-Take facility construction workers would have little to no impact on existing housing availability or cost within the area. Furthermore, there are few private lands located in close proximity to the compressor facility sites, so little to no long-term effect on private property values is anticipated.

Tax Revenue

No revenue impacts from bed taxes are anticipated as construction workers would be housed at work camps and not in local hotels or other accommodations.

Operations and Maintenance

Employment

The AGDC estimates that up to 25 workers could be employed at the Straddle and Off-Take facility and the compressor station(s) combined.

At this time it is unknown if this facility is to be manned. However, the AGDC stipulates that each compressor station would have sleeping quarters, kitchens, showers, restrooms and other amenities. Therefore, it is assumed that any O&M employee would reside at the Straddle and Off-Take facility.

Tax Revenue

The straddle and off-take facility would increase the total assessed property value in the state and YKCA, in which the facility is located. However, as the total construction cost and associated taxable value is not known, these fiscal impacts are not estimated. YKCA does not levy a property tax, however the state taxes gas transportation property at a rate of 20 mills, so for every $100 million in value, $2.0 million in state property taxes are received.

Cook Inlet Natural Gas Liquids Extraction Plant Facility

Construction

Employment

An estimate of the labor necessary to construct gas facilities related to the proposed Project has been provided by the AGDC. The number of workers necessary to construct the Cook Inlet NGLEP facility is estimated to be 100 employees over the 2016–2019 period (AGDC 2011c).

Population and Housing

It is not known how many of these construction workers would be existing Mat-Su residents. If no construction workers are Mat-Su residents, then the population would temporarily rise by up to 100 people during construction. It is anticipated that construction workers at the Cook Inlet NGLEP facility would find their own housing in the vicinity of Wasilla.

It is expected that non-resident workers would reside for the duration of proposed Project construction in the hotel, RV park, or rental home options available in the greater Wasilla area. As shown in Table 5.12-7, as of 2010 there are approximately 9,510 vacant homes within the Mat-Su, as well as multiple hotel and RV parks. Depending on the time of year of construction, this could decrease the availability of such lodging options for recreationists/tourists but is expected to have little to no effect on the housing market. Construction of the NGLEP facility could increase traffic, noise, and dust in the immediate area, but these impacts would be temporary in nature with no expected impacts on private property values.

Tax Revenue

Construction worker housing in hotels and RV parks is expected to increase local tax revenue within the Mat-Su Borough. The Mat-Su levies a 5-percent bed tax on hotel rooms. Total bed tax revenues would depend on the number of non-resident construction workers as well as the duration of the construction period. Property tax effects are discussed in operations below.

Operations and Maintenance

Employment

The AGDC estimates that 30 employees would be required for the operation and maintenance of both the Cook Inlet NGLEP facility as well as the Wasilla O&M facility combined.

Population and Housing

If all NGLEP facility employees are not existing Mat-Su residents, then the population of the borough would increase by upwards of 30 people. It is expected that personnel at the Cook Inlet NGLEP facility would provide their own housing in the vicinity of Wasilla and commute to work on a daily basis. With over 9,510 vacant housing units in the Mat-Su, potential increased demand for housing by 30 O&M employees is expected to have minor impacts on the local housing market. Impacts on property values of the facility itself are also expected to be minor, as the area is predominantly low density development with compatible adjacent land uses.

Tax Revenue

The Cook Inlet NGLEP facility would increase total taxable value in the Mat-Su and generate additional property taxes for the borough. However, the construction cost and taxable value of the Cook Inlet NGLEP facility is unknown at this time, so property taxes have not been estimated. Mat-Su taxes property at a rate of 9.956 mills, so for every $100 million in value, the borough would receive nearly $1.0 million in property taxes, while the state would also receive approximately $1.0 million. If the facility is similar in value to the GCF, then property taxes for the borough could be in the range of $39.8 million, while the state could receive $40.2 million in tax revenue.

Mainline Valves and Pig Launcher/Receivers

Construction

There would be 37 mainline valves (MLVs) along the mainline and Fairbanks Lateral. At a minimum, it is anticipated that pig launchers would be constructed at the GCF, at each compressor station, at the pipeline terminus, at the straddle plant, and at the end of the Fairbanks lateral. It is assumed that construction employment estimates provided for mainline construction include the construction labor required for MVLs and pig launchers. Thus, there would be no anticipated employment, population, housing, or hotel tax impacts associated with constructing these facilities.

Operations and Maintenance

Employment estimates for pigging facilities O&M are based upon the Mackenzie Pipeline Project and its Storm Hill pigging facility (Imperial Oil Resources Ventures Limited 2004). It is anticipated by the Mackenzie Project proponent that the Storm Hill pigging facility would be remotely monitored and operated from the main control center. Based upon the Mackenzie Project where personnel periodically visit the pigging facility, it is assumed that O&M staffing requirements for the proposed Project pigging facilities would be limited to infrequent pigging operations and that any required operation and maintenance of these facilities would be accomplished by other support facility O&M staff identified below. There would be no anticipated demand impacts on employment, population, or housing. MVLs and pig launchers would be collocated with other above ground facilities and would have no effect on housing value. Furthermore, due to their relatively low value, there would be expected minimal tax revenues generated from these facilities.

Support Facilities

Operations and Maintenance Buildings

Construction

The Prudhoe Bay O&M facility and the Wasilla O&M facility would be co-located with the GCF and the Cook Inlet NGLEP respectively. The Fairbanks O&M facility would be located in Fairbanks. The AGDC did not provide separate construction cost estimates or employment for these facilities, so it is assumed that the estimates for the GCF, straddle and off-take facility, and Cook Inlet NGLEP facility include construction cost and labor estimates for the O&M facilities. If this is the case, then some proportion of the employment, housing, population, and tax revenue impact estimated for construction of these facilities would be related to the O&M facilities.

Operations and Maintenance

Employment

The AGDC provided the estimated number of O&M employees for the proposed action as components of O&M employment estimates for other facilities. For example, the proposed Project Plan of Development (POD) stipulates that the GCF and the Prudhoe Bay O&M facility would require a total of 10 O&M employees, while a total of 30 O&M employees are required for operation of the Cook Inlet NGLEP and the Wasilla O&M facility. The AGDC estimates that a total of 10 O&M employees would be stationed at the Fairbanks O&M facility.

Population and Housing

Each O&M facility is estimated to have up to ten employees with the exception of the Wasilla O&M facility which could have as many as 30 employees. This would have negligible impacts on the population and housing demand in the vicinity of Prudhoe Bay, Wasilla, and Fairbanks.

Personnel located in Fairbanks and Wasilla would be responsible for providing their own housing within local communities. Off-site housing would be provided for Prudhoe Bay O&M workers, likely at a commercial camp located within Deadhorse. As discussed with the facilities with which the O&M building are co-located, impacts on private property values would be expected to be minimal due to either: (1) compatible adjacent land uses, or (2) minimal adjacent private lands.

Tax Revenue

The O&M buildings would increase total assessed property value and would generate additional property taxes for the state and boroughs (Mat-Su, FNSB, and North Slope) in which they are located. However, the construction cost and taxable value of the O&M facility is unknown at this time, so property taxes have not been estimated.

Construction Support: Construction Camps, Pipeline Yards, Material Sites, ROW, and Access Roads

Construction

Employment

Construction during 2016 would be dedicated to the development of the ROW, opening of material sites, gravel processing, camp development, and access road construction. The AGDC has estimated that development of these support sites would occur primarily in the summer and fall prior to mainline pipeline construction, with employment estimated at approximately 2,700 workers in the summer and 1,550 workers in the fall of 2016.

No detail was provided in employment estimates for the number of workers at each type of construction support site. However, data from similar projects provides an indication of the number of workers that could be required at each type of construction support site. For example, a typical crew involved in the construction of a pad for infrastructure development for the Mackenzie Gas Project would be 20 to 30 employees (Imperial Oil Resources Ventures Limited 2004). Assuming similar work requirements for construction camps and pipeline yards, and given that there would be 26 off-site pipe storage and lay-down yards, the total number of workers necessary to construct worker camps and pipeline yards could be in the range of 500 to 800. Similarly, the Mackenzie Gas Project anticipated that the generation of 6,540,000 cubic yards of borrow material would require between approximately 250 and 700 employees (Imperial Oil Resources Ventures Limited 2004). Assuming the same employment-to-material ratio for the proposed Project, and given that nearly 13,100,000 cubic yards of material would be required for proposed Project construction, it is anticipated that approximately 500 to 1,500 employees would be required to operate material sites.

Additional workers would be employed in pre-construction efforts to develop ROW infrastructure such as access roads. The ROW would be surveyed and staked, clearing limits defined, temporary perimeter controls installed, and existing utility lines located and marked. Clearing crews would remove all brush, timber, and stumps from the construction ROW. Machine clearing would be used in all areas except sensitive slopes. As provided in Section 2.1.3.3, the proposed Project would require 107 permanent gravel roads, of which 60 would be new, for mainline construction and operation.

As discussed in Section 2.1.3.3, the AGDC proposes the use of 546 existing material sites for proposed Project construction. Therefore, there would be no construction of new material sites or employment dedicated to new material sites.

Population and Housing

Up to 2,700 construction workers would be employed at any given time to develop construction support facilities. It is anticipated that the impacts of these workers required to construct stationary work camps would live within mobile work camps and mobilize and demobilize to these work camps primarily using air transportation. As construction worker housing needs would be met by the AGDC, there is no expected increased demand for local housing and therefore no expected changes in housing market conditions.

Furthermore, the AGDC has stated that it would avoid locating facilities in places with special visual resource values that would be observable to the general public, which would reduce the visual impact of these facilities and any associated impacts on private property value. Other possible factors that could affect private property values are related to resident anxiety of a catastrophic event. As provided in Table 5.15-24, the construction of the proposed Project is anticipated to have low impacts upon resident anxiety during this phase. Little to no impact on private property values is therefore anticipated.

Tax Revenue

The location of the Nenana work camp located at MP 476 could have implications on sales tax revenues within the nearby community. Currently a 4-percent sales tax is implemented within Nenana. As provided in Table 5.12-8, there was a total of $153,000 in sales taxes generated in 2010 and it is anticipated that sales tax revenue to the community would increase due to additional construction workers purchasing goods and services in the community.

Furthermore, the Mat-Su levies a bed tax on hotel and motel rooms while the Denali Borough implements a bed tax on hotel/motel and RV spaces. It is anticipated that most of the construction workers would reside in the work camps, but in some instances workers could reside in hotels and RV parks, and therefore increase borough tax revenue.

Material sites would result in tax revenues for the Denali Borough as it levies a $0.05-per-cubic-yard gravel tax. Assuming the nearly 13.1 million cubic yards of material for the entire proposed Project would be evenly required for each mile of the 737 miles of the mainline, the 85-mile length of pipeline located within the Denali Borough would equate to 1.5 million cubic yards and would represent tax payment of nearly $75,500 to the Denali Borough.

Operations and Maintenance

Construction camps, material sites, and pipeline yards would not be required during proposed Project operations, resulting in no impacts on employment, population, housing, or tax revenues. Continued ground surveillance and corrective erosion control and vegetation maintenance would be required for the ROW and access roads but are expected to be conducted by O&M facility employees, resulting in no additional impacts on employment, population, housing, or tax revenues.

Summary of Socioeconomic Consequences of the Proposed Action

This section provides a summary of the effects the proposed Project would have upon employment, housing, property value, tax revenues, and disadvantaged populations.

Employment

As provided in Table 5.12-14, it is anticipated that the construction of the proposed Project could require at most 9,500 construction workers over the 2016–2019 period.[9] Despite this, at most it is anticipated that 6,400 construction employees would be on-site at any given time (see Table 2.3-1). It is anticipated that the operations and maintenance of the facilities and infrastructure planned for development under the proposed action would require between 50 to 75 workers, with most workers concentrated at the facilities near Prudhoe Bay, Fairbanks, and Cook Inlet. It is anticipated that operations and maintenance jobs could last for the life of the project or an estimated 30 years (see Section 5.21, Long-Term Versus Short-Term Productivity).

TABLE 5.12-14 Proposed Project Construction and O&M Employment Estimates

Proposed Action	Total Employment[a]
Construction (2016 to 2019)	
Mainline[a]	5,500
Fairbanks Lateral	800
Gas Conditioning Facility	250
Compressor Station(s)	50 to 100
Straddle and Off-Take Facility	50
Cook Inlet NGLEP Facility	100
MVLs/Pig Launchers	Included in mainline construction estimates
Operations and Maintenance Buildings	Unknown, potentially included in other facility estimates
Construction Camps, Material Sites, ROW, and Access Roads[a]	2,700, potentially included in mainline estimates
Total[b]	**9,450 – 9,500**
Operations and Maintenance (Annual)	
Mainline	Included in O&M building estimates
Fairbanks Lateral and O&M Facility	10
Gas Conditioning Facility & Prudhoe Bay O&M Facility	10
Compressor Station(s) & Straddle and Off Take Facility	0 to 25

[9] This calculation assumes that the 2,700 construction camp, material site, ROW, and access road construction workers would not be retained for constructing other proposed Project infrastructure. If these 2,700 employees are retained for other Project construction then total maximum construction employment over the 2016-2019 period would be 6,800 employees.

TABLE 5.12-14 Proposed Project Construction and O&M Employment Estimates

Proposed Action	Total Employment[a]
Cook Inlet NGLEP Facility & Wasilla O&M Facility	30
MVLs/Pig Launchers	0
Total	**50 to 75**

[a] Maximum seasonal employment

[b] This calculation assumes that the 2,700 construction camp, material site, ROW, and access road construction workers would not be retained for constructing other proposed Project infrastructure. If these 2,700 employees are retained for other proposed Project construction then total maximum construction employment over the 2016–2019 period would be 6,800 employees.

Population, Housing, and Property Values

Non-resident construction workers would temporarily increase the population in the study area as indicated by the employment totals in Table 5.12-14. Temporary population increases could be particularly noticeable in low population density areas in the YKCA, Denali, and the North Slope. Long-term population effects from the proposed Project would be expected to be minor based on relatively low levels of operations and maintenance employment as well as the expectation that many operations and maintenance employees could be existing residents.

It is anticipated that most proposed Project construction workers would live in work camps and housing provided by the AGDC. Specifically, lodging needs for construction of the mainline from MP 0 (Prudhoe Bay) to MP 708 (Willow) would be located in worker camps developed by the AGDC. The provision of housing by the AGDC signifies that the proposed Project would not affect the demand for housing in areas surrounding these pipeline segments. Furthermore, the visual and recreation impacts described in other sections are temporary in nature, and no long-term effects on property values due to the proposed Project construction phase are anticipated.

In areas where construction workers would be required to provide their own housing, such as the construction of the final 29 miles of the proposed action, the construction of Cook Inlet NGLEP facility, and construction of the Fairbanks Lateral, it is expected that construction workers would reside in the numerous motels, RV parks, and other short-term lodging available in the Mat-Su and FNSB. It is anticipated that there would therefore be a negligible effect upon housing.

Nearly all long-term O&M employees would be expected to reside in areas surrounding support facilities. As the projected 50 to 75 long-term O&M employees would be divided between Prudhoe Bay, Fairbanks, and the Wasilla areas, the increased demand for housing would be low and the effect on local housing markets is expected to be negligible. Furthermore, impacts on private property values are expected to be minimal as above ground facilities would be expected to be located in areas with minimal adjacent private lands, or in areas where the facilities would be compatible with adjacent land uses.

Tax Revenue

There are four types of taxes associated with oil and gas production within Alaska: oil and gas production taxes, corporate income tax, royalties for lease of mineral rights, and property tax on oil and gas infrastructure. This section describes the methodology and provides estimated results of the production taxes, corporate income taxes, royalties for lease of mineral rights, and property taxes that would accrue to the State of Alaska and municipalities from the proposed action assuming current tax rates.

The AGDC is a subsidiary corporation of the Alaska Housing Finance Corporation, a public corporation and a government instrumentality within the Alaska Department of Revenue. The AGDC was created to plan, construct, and finance the proposed Project (AGDC 2011b). Once constructed, it is anticipated that the proposed Project would be operated by a private corporation, and would therefore be subject to all relevant gas taxes discussed in this section.

Natural gas production taxes are based upon net value of the gas, which is the value of gas at the point of production less all qualified lease expenditures. The production tax rate per unit of natural gas produced thus varies based on market price and production costs. As defined by AS 43.55.900, the point of production for natural gas is the first point where the gas is accurately metered following the completion of mechanical separation. The point of production for this analysis is thus assumed to be the GCF and therefore part of the proposed action.

Alaska natural gas and oil production volume and production taxes in 2010 were used to estimate expected Project production taxes (U.S. Energy Information Administration 2011). The State of Alaska does not report natural gas production tax revenues separately from oil production taxes, so it is assumed that the portion of all production taxes from natural gas is equivalent to its proportion of all production (ADR 2010). At 376,955 million standard cubic feet (MMscf) or 68.7 million barrels oil equivalents, natural gas production in Alaska accounted for approximately 20 percent of total Alaska oil and gas production in 2010.[10] It was assumed that 20 percent of 2010 oil and gas production tax revenues, or $638 million, were due to natural gas production.

A conservative estimate of natural gas production from the proposed Project was used for this analysis. As provided by the AGDC, initially it is expected that the proposed Project would produce 250 MMscf per day or 91,250 MMscf per year. This would represent an increase of approximately 24 percent from 2010 natural gas production within Alaska. Therefore, assuming that net value per MMscf of natural gas production remains fairly constant, it is estimated that development and operation of the proposed Project would increase gas production tax revenue by approximately 24 percent and support an additional $154 million in annual natural gas production tax revenue for the State of Alaska (see Table 5.12-15). As described by the AGDC, it is anticipated that full capacity of the proposed Project would be 500 MMscf per day. Once the proposed Project begins this level of production, then it could be expected that the estimated annual production taxes would increase from the $154 million as described above to $309 million.

[10] Natural gas was converted into barrels of oil equivalents (BOE) (68.7 MMbbl) and combined with total Alaska crude oil production in 2010 (240.6 MMbbl) to estimate the total production of oil and natural gas BOE produced in Alaska for 2010 (309.3 MMbbl).

Similar to production taxes, the State of Alaska does not separately report oil and gas corporate tax revenue. The same methodology as described for natural gas production tax revenue was used to estimate proposed action corporate tax effects. In 2010, oil and gas corporate tax revenue was $447.9 million. As natural gas accounted for 20 percent of total oil and gas production in 2010, $99.5 million is assumed to have accrued from natural gas production. Based on an estimated increase in natural gas production of 24 percent due to the proposed Project, corporate petroleum tax revenues from natural gas are expected to increase by 24 percent or approximately $24 million annually. As described by the AGDC, it is anticipated that at full capacity, the proposed Project would be 500 MMscf per day. Once the proposed Project begins this level of production, then it could be expected that these estimated corporate taxes would increase from the $24 million annually as described above to $48 million.

The State of Alaska receives royalty payments for oil and gas produced from State lands leased to oil and gas producers. Royalties are based upon the agreed value of the oil or gas removed from the lease, the volume removed, and the royalty rate (State of Alaska 2011). Royalties are due to the State once natural gas leaves the unit or enters a common carrier pipeline (J. Stouffer, Pers. Comm. 2011). Therefore it is assumed that royalty payments would be associated with the GCF. Using the same approach as provided for production taxes and corporate taxes it assumed that natural gas accounts for nearly $328.0 million (approximately 20 percent) of the total $1.48 billion in royalties collected by the State of Alaska in 2010. Provided that natural gas production within Alaska would increase by 24 percent due to proposed Project construction, an additional $79.4 million dollars in royalties would be collected by the State of Alaska.

The State of Alaska also levies a property tax, discussed in more detail below. Table 5.12-15 below summarizes estimated annual taxes to the State of Alaska during the first year of the proposed Projects' operation, including gas-production, corporate, and property taxes. These are estimated to total $358.6 million, with the majority ($154 million) from gas production taxes.

TABLE 5.12-15 Estimated State Tax Revenue from Proposed Project (at 250 MMscf)

Tax Type	State of Alaska (millions of dollars)
Royalties	$79.4
Gas Production Taxes	$154.4
Corporate Taxes	$24.1
Property Taxes (Year 1)	$100.7
Total	$358.6

Some municipalities in the study area levy property taxes, bed taxes, sales taxes, and gravel taxes, through which the proposed Project would increase local tax revenues. The State of Alaska levies a 20.00 mill rate (2 percent of full and true value) on pipeline transportation property, but credits property taxes paid to municipalities such that the maximum combined property tax paid to the state and to municipalities is at the 20.00 mill rate. A municipality may levy and collect a tax at the same rate as other property taxed by the municipality. The tax on pipeline transportation property cannot exceed the mill rate for other property within the municipality. For example, if a municipality has an existing mill rate of 8.00, such as with Nenana, the city can implement a mill rate of 8.00 on the assessed value of the pipeline transportation property. The State of Alaska would subsequently implement a mill rate of 12.00 in order to obtain the combined mill rate of 20.00 as mandated by AS 43.56.010.

The development of a pipeline and supporting facilities would create taxable property and therefore increase the value of this type of property for the State of Alaska and for jurisdictions with these developments. Table 5.12-16 below estimates the "full and true" taxable value of the pipeline and the GCF ($8.4 billion) to each borough, CA, and municipality traversed based on the mileage of the pipeline and the support facilities located in each jurisdiction. According to AS 29.45.110, the full and true value is the "estimated price that the property would bring in an open market and under the then prevailing market conditions in a sale between a willing seller and a willing buyer both conversant with the property and with prevailing general price levels". It is assumed that the cost of construction is a good approximate for initial proposed Project full and true value (with expected lower values in later years due to depreciation). Construction cost estimates for many of the support facilities are not available at this time so property tax revenues from these support facilities are not included in Table 5.12-16. Therefore, Table 5.12-16 should be considered a conservative estimate of proposed Project total value.

TABLE 5.12-16 Value of ASAP Pipeline and GCF within Boroughs/CA and Municipalities, Year 1

Municipality	Miles of Pipeline within Municipality	Value of ASAP (millions of dollars)
Denali Borough[a]	77.35	$441.5
Fairbanks North Star Borough	29.66	$169.3
Mat-Su Borough	160.85	$918.2
North Slope Borough[b]	186.86	$5,066.6
Yukon-Koyukuk Census Area[a]	304.99	$1,741.0
Nenana	3.4	$19.4
Anderson	7.7	$44.0

[a] Nenana and Anderson pipeline length and values have been deducted from Denali Borough and the YKCA to avoid double counting.

[b] The full value of ASAP within the North Slope Borough both include the mainline and the GCF construction.

There is one other restriction on municipal property taxes collected on oil and gas infrastructure. As provided by AS 43.56.101.D, a municipality may levy and collect a tax on the full and true value of the portion of pipeline property if the total value of assessed property (including the pipeline infrastructure) does not exceed a specified property value cap.[11] If this property value cap is exceeded by the municipality, the Alaska Department of Revenue will determine the portion of the tax base which the local tax authority may use for taxation of pipeline transportation projects.

As indicated in Table 5.12-17 below, the North Slope Borough is close to exceeding this tax cap, in which case the estimated property taxes presented below for the North Slope could be reduced and these tax revenues distributed to the state. The North Slope is allowed to use a larger proportion of the workforce in Prudhoe Bay to count in the tax cap formula. Therefore, the tax cap calculation for the North Slope in Table 5.12-17 uses a higher population figure than the number of North Slope residents. The North Slope population estimate used in deriving the operating budget for 2011 (17,520 people) was upwardly adjusted to 17,530 people to reflect the estimated number of GCF and Prudhoe Bay O&M workers identified in this analysis (Alaska Department of Commerce 2010).

TABLE 5.12-17 Property Tax Cap Determination for Municipalities

Municipality	Full Value of ASAP	Local Assessed Value 2010	Total of Local Assessed and ASAP	Tax Cap Calculation
Denali Borough	$441.5	$0.0	$441.5	$568.5
Fairbanks North Star Borough	$169.3	$6,794.5	$6,963.8	$30,315.5
Mat-Su Borough	$918.2	$7,580.6	$8,498.8	$27,650.0
North Slope Borough	$5,066.6	$334.3	$5,400.9	$5,446.1
Nenana	$19.4	$0.0	$19.4	$76.4
Anderson	$44.0	$0.0	$0.0	$0.0

Notes: Estimated value of ASAP includes both the mainline and the GCF construction costs.

Table 5.12-18 summarizes the estimated property tax revenues for each municipality traversed by the proposed action as well as property tax revenues to the state. The proposed Project is estimated to pay approximately $168.0 million in year one prior to depreciation, with $67.3 million paid to local jurisdictions and $100.7 million to the state. These estimated property tax revenues include the GCF facility but not the value of other support facilities, such as the Cook Inlet NGLEP facility, due to lack of data. To estimate the value of pipeline infrastructure within each municipality traversed by the pipeline, it was assumed that each mile of pipeline infrastructure has equal value. The average per mile construction value of $5.7 million ($4.4 billion construction cost divided by 770 miles of mainline and lateral construction) was then allocated to municipalities based on the length of pipeline located within each municipality. The GCF construction cost of $4.0 billion was included in property tax calculations for the North Slope Borough. The property tax values presented in Table 5.12-18 represent revenue estimates in the first year that the proposed Project would be operational. As proposed Project infrastructure depreciates, property taxes would decrease.

[11] Natural gas was converted into barrels of oil equivalents (BOE) (68.7 MMbbl) and combined with total Alaska crude oil production in 2010 (240.6 MMbbl) to estimate the total production of oil.

As provided in Table 5.12-18, Denali Borough and Anderson are two municipalities traversed by the proposed action that have taxing authority but do not implement a property tax. Under these circumstances the municipalities could not levy a separate pipeline transportation property tax (A. Ziegman, Pers. Comm. 2011). This analysis estimates property tax revenues using current property tax rates; if these rates are modified, revenues would adjust accordingly.

TABLE 5.12-18 Projected Municipal Property Tax Revenues from Proposed Project, Year 1

Municipality	Miles of Pipeline within Municipality	Total Estimated Value of ASAP ($ millions)	2010 Mill Rate	Local Property Tax Revenue ($ millions)	State Property Tax Revenue ($ millions)	Total Property Tax Revenue ($ millions)
Denali Borough	77.35	$441.5	0.000	$0.0	$8.8	$8.8
Fairbanks North Star Borough	29.66	$169.3	11.432	$1.9	$1.5	$3.4
Mat-Su Borough	160.85	$918.2	9.956	$9.1	$9.2	$18.4
North Slope Borough[a]	186.86	$5,066.6	11.060	$56.0 (GCF $44.2, Mainline $11.8)	$45.3	$101.3
Yukon-Koyukuk Census Area	304.99	$1,741.0	0.000	$0.0	$34.8	$34.8
Nenana[b]	3.4	$19.4	8.000	$0.2	$0.2	$0.4
Anderson[b]	7.7	$44.0	0.000	$0.0	$0.9	$0.9
Study Area Total	770.81	$8,400.0	NA	$67.3	$100.7	$168.0
State of Alaska	770.81	$8,400.0	20.000	NA	$100.7	$168.0

[a] Estimated value of ASAP includes both the mainline and the GCF construction costs.

[b] The value or pipeline facilities within Nenana and Anderson have been deducted from the value of pipeline within the YKCA and the Denali Borough to avoid double counting.

Additionally, other boroughs could receive additional tax revenue from construction workers staying at hotels and RV Parks. The Mat-Su, Denali, and FNSB implement a 5-percent, 7-percent, and 8-percent bed tax respectively on hotel rooms. The 7-percent bed tax applies to RV spots in the Denali Borough. It is anticipated that construction workers that reside in hotels along with RV spots in the Denali Borough would increase tax revenue for these boroughs.

Material sites in Denali Borough would also generate tax revenues for the borough, as it has a $0.05-per-cubic-yard gravel tax. If the nearly 13.1 million cubic yards of material for the entire proposed Project was evenly distributed for each mile of the 770 miles of the mainline, the 85-mile length of pipeline located within the Denali Borough would require 1.5 million cubic yards and would represent a tax payment of nearly $72,000 to the Denali Borough.

Quality of Life

The proposed Project's development could negatively impact other aspects of quality of life for residents within the study area based on changes in environmental quality. Quality of life in the proposed Project area could be negatively impacted by changes in traffic density and changes in natural resources or environmental quality including air quality, water quality/quantity, or habitat. For example, adverse effects to water and air quality could have implications on human health (see Section 5.15, Public Health). Furthermore, quality of life could be affected by access restrictions, alteration to visual resources, and recreational activities due to the proposed Project.

Additionally, subsistence resources in some areas could be affected through increased hunter efforts, costs and risks. As provided in Section 5.14.3.2 Subsistence, in the short-term blasting can displace or divert subsistence resources due to noise from these activities. Furthermore, potential subsistence impacts from the construction of stream crossings include habitat alteration and loss as well as reduced survival and/or productivity for fish (see Sections 5.6.2.2 and 5.14.3.2). However, large scale impacts on fish populations are not indicated in Section 5.6, Fish.

In general, as analyzed in other sections of this EIS, these types of impacts would be concentrated during the temporary construction phase (with the exception of potential invasive species introduction) due to increased traffic, dust, noise, and construction delays; they are expected to be of minor to moderate magnitude. Long-term effects on these components of quality of life are expected to be negligible to minor.

Environmental Justice

As discussed in Section 5.12.2.2, Executive Order 12898 is intended to ensure that federal actions and policies do not result in disproportionately high adverse effects on minority or low-income populations. The analysis of environmental justice effects of the proposed action identifies areas with minority and low income populations. Specifically, two CTs that would be traversed by the proposed action have minority populations in excess of or near 50 percent. North Slope CT 200 and YKCA CT 200 have a particularly high concentration of AIAN population, 86.5 percent and 48.8 percent respectively (see Figure 5.12-4). These are the only CTs in which the concentration of a minority group exceeds the statewide average. There are a few instances where the concentrations of minority populations are slightly higher than their respective borough or CA. For example, FNSB (CT 1300), Mat-Su (CT 400, 500, and 600), North Slope (CT 200 and 300), and the YKCA (CT 200) each have a slightly higher representation of minority populations within the CTs traversed by the proposed action when compared to their respective borough/CA overall.

Of the 10 CTs that would be traversed by the proposed action, all but three have higher poverty rates than the statewide average. Poverty rates in the YKCA and the North Slope are much higher when compared to the state, with 23.8 and 14.4 percent population impoverished respectively. While higher than statewide averages, poverty rates for those CTs that would be traversed by the proposed action within the North Slope and the YKCA do not exceed the overall poverty rates within their respective borough or CA.

Five of the CTs have higher poverty rates than the borough in which they are located. Each of the CTs traversed within the FNSB (CT 1300 and CT 1900) has a higher poverty rate than the FNSB overall poverty rate. Similarly, three CTs that would be traversed by the proposed action within Mat-Su Borough (CT 100, CT 400, and CT 500) have poverty rates that are higher than the overall borough poverty rate.

As provided in Sections 1.4 and 1.5, there have been multiple opportunities for public involvement for the communities of concern. Scoping meeting advertisements and how to obtain additional project information was sent by the USACE to affected parties and community leaders (see Section 1.4.1.1)[12]. Announcements for public scoping meetings were advertised through a variety of media such as local and state-wide newspapers, online news resources, and radio stations. Informational meetings were held to introduce the proposed Project and solicit public comment from the affected communities. Initial meetings were held in Glennallen, Delta Junction, Nenana, Fairbanks, McKinley Village, Anchorage, Wasilla, and Barrow (see Table 1.4-1). Each meeting included an open house, a brief formal presentation, and a public question and comment period. After publication of the Draft EIS, the process to advertise the public comment period was repeated and informational meetings were held in Kenai, Anaktuvuk Pass, Fairbanks, Nenana, Cantwell, Trapper Creek, Willow, Anchorage, Barrow, Wiseman/Coldfoot, and Minto (see section 1.5.2). As a result of public input during the scoping and review phases, various mitigation measures have been proposed by the AGDC for local residents (see Section 5.23.2.12). These mitigation measures include the development of an Economic Opportunity Plan, coordination with local training centers, and the use of local businesses to support the proposed Project. Coordination and consultation with local groups and is discussed in detail in Section 1.4.

In general, it is expected that minority and low-income communities would be positively affected by the proposed Project through the creation of both temporary and permanent jobs, as well as income- and tax-effects. While the proposed Project would increase employment during construction, leading to increased discretionary income for some area residents, this effect would be temporary and would cease after the construction period. However, during the operations phase, area residents (50 - 75 employees) could be employed for the life of the project (30 years). Some adverse quality of life effects are anticipated on many communities adjacent to the proposed Project during the construction phase due to increased traffic, noise, and possible effects to subsistence, but those adverse effects would be expected to be minor to moderate, of a temporary nature, and would not be concentrated in low income or minority areas. Avoidance or minimization of potential adverse impacts upon communities' quality of life include mitigation measures as proposed by the AGDC in Sections 5.23. Overall, it is determined that there are minor to no environmental justice effects of the proposed action and alternatives upon low-income and minority groups.

5.12.3.3 Denali National Park Route Variation

Construction

The Denali National Park Route Variation is a 15.3 mile segment that, if selected, would replace 15.5 miles of the mainline as provided in the proposed action. The impacts to socioeconomics resulting from the development of the Denali National Park Route Variation would be similar to those of the segment of proposed pipeline and would be negligible.

[12] Notice of meetings, opportunities for input and information on the availability of project documents was also provided to 28 tribes representing the people in the potentially affected area (see Section 1.3).

It is anticipated that the construction workers would either reside in the Healy (MP 531) or Cantwell (MP 570) work camp. Given the close proximity of this route variation to the communities of Cantwell, Healy, and McKinley Park it is anticipated that some employment could be provided by area residents, who could potentially commute from their residences.

Additionally, the Denali Borough implements a 7-percent bed tax on hotel rooms and RV spaces. Therefore, it is anticipated that construction workers that reside in hotels and RV spots while constructing the Denali National Park Route Variation would increase tax revenue for the borough.

Other potential effects resulting from material used within the Denali National Park Route Variation would be from tax revenues for the Denali Borough for the $0.05-per-cubic-yard gravel severance tax. If the nearly 13.1-million cubic yards of material for the entire proposed Project was evenly required for each mile of the 770 miles of the proposed Project, the 15.27-mile length of pipeline located within the Denali Borough would require 260,000 cubic yards and would represent a tax payment of nearly $13,000 to the Denali Borough.

The Denali National Park Route Variation would be located within the Denali Borough. As previously described, there is only one CT within the Denali Borough; therefore, no discrepancy exists between the CT level and borough level for race or poverty characteristics. However, when compared to Alaska statewide, there are no higher concentrations of any minority group or impoverished populations within the Denali CT 100. The Denali Borough has less racial diversity than Alaska statewide, with approximately 10.4 percent of the population belonging to a minority group. It is not believed that construction of the Denali National Park Route Variation would place an inequitable burden upon minority or low-income communities.

Operations

Under the proposed action, there are an estimated maximum of 50 O&M employees for the pipeline component of the proposed Project. Provided that the proposed pipeline is approximately 770 miles in length, this translates to approximately 0.07 O&M employees per mile. Given that the Denali National Park Route Variation is 15.27 miles in length, the total number of O&M employees for this segment is assumed to be a maximum of one full time job.

The same methodology provided for determining the value of the proposed Project was used to determine that the 15.27-mile Denali National Park Route Variation would be valued at $87.2 million. As previously described, the Denali Borough is not able to levy a pipeline property tax. Despite this, the State of Alaska would be able to levy a pipeline property tax for the Denali National Park Route Variation. It is anticipated that the State of Alaska would levy nearly $1.7 million in property taxes for the Denali National Park Route Variation.

The total gas production taxes attributable to the Denali National Park Route Variation were estimated using the average per mile production tax revenue of $0.20 million ($154.4 million production tax revenues divided by 770 miles). This average per mile production tax revenue was then allocated the 15.27-mile segment to determine that $3.1 million in production tax revenue would be attributable to the Denali National Park Route Variation. Similarly, the average per-mile corporate tax revenue was used to determine that the Denali National Park Route Variation would generate approximately $500,000 in corporate taxes annually. Royalties associated with the Denali National Park Route Variation equate to $1.6 million annually.

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5.13 CULTURAL RESOURCES

Cultural resources within the proposed Project area may include sites and materials of prehistoric Native American (e.g., stone quarries, game lookouts, tool manufacturing sites, house and cache pits, camp sites, villages, and stone tent rings), historic European and Euro-American, and historic Iñupiat and Athabascan origin (e.g., traditional cabin sites, camp sites, burial grounds, traditional subsistence harvest sites, other traditional land use areas, landscapes, and place names).

The purpose of this section is to describe cultural resources in the area of the proposed Project, including surface and subsurface pipelines and rights of way, and temporary and permanent ancillary facilities. It should be noted that not all areas of the proposed Area of Potential Effect (APE)[1] have been surveyed for cultural resources and that this section relies on previously documented cultural resources (including baseline work conducted for the proposed Project through 2010) for the analysis of effects. Additional surveys along the proposed Project would likely result in the documentation of additional cultural resources. This discussion identifies reported cultural resources in the study area and the potential for undiscovered or undocumented cultural resources that may be affected by the proposed undertaking.

The cultural resources analysis relies on:

- Alaska Heritage Resource Survey (AHRS) (reviewed and updated for this EIS in April of 2011) files located at the Alaska Department of Natural Resources, Office of History and Archaeology (ADNR, OHA), RS 2477 trail (e.g., public rights of way) database maintained by the ADNR, Division of Mining, Land and Water, and North Slope Borough (NSB) Traditional Land Use Inventory (TLUI) sites;
- An assessment of available literature regarding cultural resources in the proposed Project area, including the Arctic Slope Regional Corporation Energy Services (AES) (2010, 2011) cultural resource baseline reports prepared for the proposed Project; and
- The application of existing laws and regulations regarding the assessment of effects on cultural resources caused by an undertaking.

5.13.1 Regulatory Environment

The relevant regulations for the evaluation of effects to cultural resources are the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 CFR [Code of Federal Regulations] Part 800). The NEPA requires a review of project and program impacts on the cultural environment, which includes historic properties (as defined in Section 106), other culturally valued places, cultural use of a biophysical environment (e.g., religious, subsistence), and sociocultural attributes

[1] Direct APE: effects are those that occur within the ROW and footprint of proposed Project components. Indirect APE: 1 mile geographic area within which the proposed Project could indirectly alter the character or use of a cultural resource.

(e.g., social cohesion, social institutions, lifeways, religious practices, and/or other cultural institutions) (National Preservation Institute 2011).

The NHPA requires federal agencies to consider the effects of their undertakings on historic properties (i.e., cultural resources that are eligible for the National Register of Historic Places [NRHP]) and to provide a reasonable opportunity for interested parties to comment on such undertakings. Section 106 applies when a project has been determined to be an undertaking, which is defined as a project, activity, or program funded in whole or part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on the behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license, or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency (36 CFR 800.16[y]). If the undertaking will have an adverse effect on historic properties, the agency must continue to consult with interested parties to resolve the adverse effects. Federal agencies follow the Section 106 process in reviewing project activities and prescribing appropriate actions to meet the requirements for compliance.

The NHPA defines historic properties as prehistoric and historic districts, sites, buildings, structures, and objects listed on or eligible for inclusion on the NRHP including artifacts, records, and material remains related to the property (NHPA, 16 USC [United States Code] 470w, Sec. 301.5). Consideration is given to both the criteria of significance and integrity of the property's historic qualities. The NRHP was created with the passage of the NHPA of 1966 (16 USC 470 Sec. 101). For a historic property (e.g., districts, sites, buildings, structures and objects) to be eligible for the NRHP, it must be significant (i.e., meet one or more of the NRHP criteria) and possess integrity of location, design, setting, materials, workmanship, feeling and/or association (36 CFR 60.4). For the proposed Project of the cultural resources analysis, all cultural resources are assumed to be eligible for the NRHP unless stated otherwise. Congress passed the Act to preserve and protect the nation's historic properties in response to the country's rapid expansion and development, and the effects to the historic and cultural landscape of federal projects including the Interstate Highways and Urban Renewal programs.

Other relevant legislation that applies to cultural resources includes the Antiquities Act of 1906,16 U.S.C. § 431; the Archaeological Resources Protection Act of 1979, 16 U.S.C. § 470; the National Trails System Act, 16 U.S.C. § 1241; the American Indian Religious Freedom Act of 1978, 42 U.S.C. § 1996; Section 4(f) of the U.S. Department of Transportation Act of 1966, 49 U.S.C. § 303; the Archaeological and Historic Preservation Act of 1974 ("Moss-Bennett" Act), 16 U.S.C. § 469; Executive Order (E.O.) 11593: *Protection and Enhancement of the Cultural Environmen;* E.O. 13007: *Indian Sacred Sites*; E.O. 13287: *Preserve America*, 61 *Federal Register* 25131(May 17, 1996); and the Native American Graves Protection and Repatriation Act, 25 U.S.C. §§ 3001- 3013.

The Section 106 process involves the development of the APE, as well as a Programmatic Agreement (PA) between the State Historic Preservation Office (SHPO) and the Lead Agency (USACE for this proposed Project) and the cooperating agencies that have chosen to participate (at this time the BLM is the only additional agency that has asked to be a party to the PA; other agencies will utilize the completed work for their purposes). The PA will lay out a phased completion process for continued surveying and identifying of previously unknown cultural resources, as well as the processes for monitoring and potential discovery of previously unidentified cultural resources, including human remains, during construction, and the process for mitigating potential adverse effects which have not yet been identified. It will also include collection and curation policies, construction monitoring, monitoring for looting activities, etc.

5.13.2 Affected Environment

The study area includes the proposed Project ROW, with 730 miles of buried and 6 miles of aboveground pipe, access roads, and a suite of temporary and permanent facilities. Permanent facilities would include a gas conditioning facility (GCF) at Prudhoe Bay, a maximum of 2 compressor facilities, a straddle and off-take facility to provide utility grade natural gas for the Fairbanks Lateral, 37 mainline valves (MLVs) and 5 pig launcher/receiver stations, 3 metering stations, and the Cook Inlet Natural Gas Liquids Extraction Plant (NGLEP) Facility and pipeline terminus. Temporary facilities would include construction support facilities such as proposed Project offices, construction camps, laydown and work pad areas, pipe storage areas, fuel storage areas, and access roads.

The proposed Project would cross 3 ecological regions of the state: the North Slope (approximately MP 0 to 174), the Interior (approximately MP 174.1 to 580), and Southcentral (approximately MP 580.1 to 737). These 3 regions include 2 major cultural groups, the Iñupiat and the Athabascans, divided by the Brooks Range, which separates the North Slope from the interior of Alaska. Athabascan language speaking peoples along the route include the Koyukon, Tanana, Ahtna, and Dena'ina. The Koyukon and Tanana speaking peoples live in the Interior, from the Brooks Range to the Alaska Range, and the Ahtna and Dena'ina live south of the Alaska Range in the Matanuska, Susitna, and Copper River valleys.

5.13.2.1 North Slope Region

Overview of Regional Prehistory (12,000 years ago to 1815 A.D.)

Paleoindian / Paleo-Arctic

The early prehistory of the North Slope area has been documented at numerous sites in northern Alaska. The oldest sites found date from the end of the Pleistocene era, perhaps 12,000 years ago, to the early Holocene some 10,000 years ago. These sites are attributed to bearers of the Paleoindian and Paleo-Arctic tool traditions (Table 5.13-1). The Paleoindian tradition is thought to be the tool technology of the earliest migrants into the North American Arctic, whose bifacial stone tool (i.e., with flaking on two sides of a flat core or preform) technology is considered by archaeologists to be specific to procuring large mammals such as bison, musk oxen, and caribou. Paleoindian sites on the North Slope include the Bedwell site (PSM-00027) (Reanier 1996, Bever 2006), the Mesa Site (KIR-00102) (Kunz and Reanier 1996), and the Hilltop Site (PSM-00017) (Reanier 1995). These sites contain data on Old World to New World cultural diversification and human occupation of eastern Beringia at the end of the last glacial episode. They represent the most ancient known locale of human occupation on Alaska's North Slope.

TABLE 5.13-1 Sequence of North Slope Archaeological Cultures

Tradition	Date	Finds	Representative Sites
Historic Iñupiat	AD 1826 – present	Stone, metal, trade goods, organic artifacts, plus historic, ethnographic and informant accounts	Bullen Point, Point Hopson, Natvavak
Late Prehistoric (Birnirk, Thule)	2,000 BP–- AD 1826	Lithic, wood, leather, bone artifacts, house ruins	Pingok Island, Thetis Island, Niglik, Birnirk, Walakpa, Point Hope, Cape Krusenstern, Nunagiak, Utqiaġvik, Nuwuk
Arctic Small Tool (Denbigh, Choris, Norton, Ipiutak)	4,500–1,200 BP	Diminutive lithic microtools, cores, burins, blades	Putuligayuk River, Central Creek Pingo, Onion Portage, Mosquito Lake, Choris, Walakpa, Iyatayet, Point Hope, Coffin, Jack's Last Pingo, HAR-047, TES-008, TES-009, TES-012
Northern Archaic	6,000–3,000 BP	Side-notched points, microblades, bone tools	Putuligayuk River, Kuparuk Pingo, Kurupa Lake, Tuktu
Paleo-Arctic	10,000–7,000 BP	Cores and blades, microcores, microtools, bifaces	Putuligayuk River, Jones Pingo, Gallagher Flint Station, Lisburne, Tunalik
Paleoindian	12,000–9,800 BP	Extinct fauna, large lanceolate points, bifaces	Mesa, Bedwell, Putu, Hilltop

BP – Before Present (i.e., years ago).
Sources: Table 2 from Lobdell and Lobdell 2000: Table 1 from Reanier 2002: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

The Old World affiliated Paleo-Arctic tradition continued through the Holocene, while no Paleoindian sites have been found on the North Slope that date later than 9,800 years ago. The Paleo-Arctic tradition is generally defined as a stone tool industry that utilized a core and blade technology that produced unifacial tools such as burins, scrapers, and drills on blades. Evidence of the Paleo-Arctic Tradition is found at sites across the North Slope, including Gallagher Flint Station near Galbraith Lake (PSM-00050)(Dixon 1975)(Ferguson 1997) and the Lisburne Site, 5 miles north of the Mesa Site in the Iteriak Creek valley (KIR-00096) (Bowers 1982, 1999). Although it is difficult to determine an end date for this cultural tradition, it is believed to have occurred sometime after 8,000 years ago (Anderson 1970). The Paleoindian and Paleo-Arctic sites discussed above contain cultural remains that could contribute to research questions associated with the ways in which humans adapted to environments of the high latitudes in North America and the arrival of humans in the region at the Pleistocene-Holocene boundary.

Northern Archaic

The transitional Ice-Age cultures were followed by a group referred to generically by archaeologists as Northern Archaic peoples (Table 5.13-1) (Anderson 1968). Peoples using Northern Archaic technology, usually distinguished by corner notched arrow type points, inhabited the North Slope from sometime after 8,000 years ago to as recently as 2,000 – 3,000 years ago. Most Northern Archaic artifacts found throughout the Arctic Foothills and the Brooks Range are surface finds (Lobdell and Lobdell 2000). More recently, researchers have found better stratified sites and acquired more information about the environment and climate of the time, leading to some reassessment of the period (Esdale and Rasic 2008).

Northern Archaic sites in the vicinity of the proposed Project area include the Putuligayuk River Delta Overlook site at Prudhoe Bay (XBP-00007), the Kuparuk Pingo site (XBP-00033), the Kurupa Lake archaeological district in the foothills of the Brooks Range (e.g., KIR-00124), and the Tuktu site north of Anaktuvuk Pass (XCL-00003) (Lobdell 1985, 1986, 1995; Lobdell and Lobdell 2000; Reanier 2002; Schoenberg 1995). The location of the Kuparuk Pingo site adjacent to the north Alaska coast indicates that Northern Archaic people used coastal or ice edge resources in addition to the terrestrial fauna long believed to be the primary focus of Northern Archaic subsistence (Lobdell 1995).

Arctic Small Tool Tradition

Earliest documentation of the Arctic Small Tool tradition (ASTt) in Alaska is from approximately 4,800 years ago at Cape Denbigh (NOB-00002) and Kuzitrin Lake (BEN-00107) in the central Seward Peninsula (Table 5.13-1) (Harritt 1994). The ASTt is generally believed to be the earliest archaeological tradition associated with modern Iñupiat people (Reanier 2002). While the ASTt people were not among the first residents of the North Slope, their more varied and sophisticated technology allowed them to more fully exploit the resources of the region than their predecessors. ASTt-bearing populations expanded into Canada, Siberia, and Greenland, and there is an unbroken record of their use of the North Slope since their first appearance in the archaeological record (Reanier 1997, Sheehan 1997). ASTt components are characterized by a chipped stone industry of small, well-made bifacial projectile points, ground stone implements, a variety of carefully crafted and decorated bone, ivory, and antler tools and items of personal adornment, and a proliferation of composite tools (Irving 1964, Dumond 1987). The succession of the ASTt phases began with the Denbigh Flint Complex, followed by the Choris, Norton, and Ipiutak cultures (Irving 1964, Giddings 1964, Dumond 1987). These early ASTt people may have spent as much or more time living in and exploiting the subsistence resources of the foothills and mountains of the Brooks Range as they did the coast.

Late Holocene Cultures

Beginning approximately 2,000 years ago, ancestral forms of the historic Iñupiat culture emerged and became the cultural forms encountered by European and Euro-American explorers in the nineteenth century (Table 5.13-1).

The Birnirk phase, a direct ancestor of the historic Thule culture, appeared in the Bering Strait by 1,600 years ago. From the Birnirk period onward, the cultural continuity of arctic peoples into the twenty-first century is well established. Birnirk peoples lived in semi-subterranean winter houses and engaged in the harvest of marine and land mammals, birds, and fish. The Birnirk type-site (BAR-00001) is located near Barrow at the base of the Barrow spit (*Piġniq*). Birnirk-style artifacts have been found from northeastern Siberia to northwestern Canada, indicating a large trade network reminiscent of the extensive Iñupiat trade network in place at historic contact.

Thule is the immediate prehistoric ancestor of the various historic Iñupiat groups. Approximately 1,000 years ago, a favorable climate coupled with technological innovations such as the *umiaq* (a large skin boat), the *qataq* (cold trap door for winter houses), and the *uniat* (sled) resulted in the rapid expansion of Thule populations from the Bering Strait along the shores of the Beaufort Sea to Greenland, and southeast around the shores of the Bering Sea ultimately to Kodiak Island and Prince William Sound (Fitzhugh 2003). Thule persisted in the North American Arctic to historic contact, between 1800 and 1850 (Collins 1964, Giddings and Anderson 1986). Thule people hunted sea mammals, including seals and whales, fished, and hunted terrestrial game such as caribou. Salmon were also an important subsistence resource in some areas with Thule associations. Thule sites include *Nuwuk* (BAR-00011), *Utqiaġvik* (BAR-00002), Thetis Island (HAR-00001, destroyed), Pingok Island (XBP-00012), and Niglik (HAR-00169; also *Neglik, Nigliq*).

At the same time as Thule on the coast, related but less numerous populations continued to exploit the resources of the interior, primarily subsisting on caribou and other large terrestrial mammals, and overwintering on the margins of lakes that contained plentiful fish resources (Gerlach and Hall 1988). These people may have been the antecedents of the modern Nunamiut or Inland Eskimo; Athabascans from the Interior, or may reflect part of an extensive cyclical land use pattern (Peter Raboff 2001).

Overview of Regional History

Some of the earliest recorded observations of northern Alaska and its inhabitants occurred in the Arctic region in the early to mid-nineteenth century when contact between Euro-American explorers, as well as the arctic whaling fleet, and Alaskan Natives first occurred. The following years of continuous contact between commercial whalers and North Slope Iñupiat altered the traditional culture (e.g., populations, subsistence practices, and settlement patterns) (Bockstoce 1978, 1995). The following descriptions outline the history in the region.

European/Euro-American Expansion, Exploration, and Ethnographic Research

The exploratory period on the North Slope began in 1826 with the second of three Franklin expeditions. Sir John Franklin and his crew descended the Mackenzie River, overwintered at Fort Franklin, and sailed westward from the delta to the Return Islands, just west of Prudhoe Bay. That same year, Beechey's expedition sailed north from the Bering Strait to Point Barrow. Franklin, as well as other early explorers, noted that the presence of European trade goods (such as tobacco, iron, and copper) preceded their arrival among the Iñupiat on the North Slope. Between 1847 and 1854, contact between Europeans, Americans, and the Iñupiat increased because of the influx of whalers to the region. Exploration of the region further increased as ships searched for the third Franklin expedition, launched in 1845 in the ships *Erebus* and *Terror*. During the commercial whaling period, items such as metal tools and firearms became increasingly important as part of Iñupiat material culture. By the 1850s, guns were in use by local Iñupiat people, and by the 1880s, Iñupiat whalers were using the darting guns and bombs used by commercial whalers. During the last quarter of the nineteenth century, smallpox and influenza outbreaks caused a severe population decline among the North Slope Iñupiat, and declines in caribou populations resulted in famine that forced inland Iñupiat to leave their homes and relocate to coastal communities such as Barrow (Reanier 2002).

Interest in the geology and history of the early culture of the area began in earnest at the beginning of the twentieth century, but access was limited to coastal areas. Stefansson conducted ethnographic studies along the coast east of Barrow in 1906–1907, 1908–1912, and 1913–1918. Between 1906 and 1914, geologist Ernest de K. Leffingwell conducted geological and geographical research along the Arctic coast, based from Flaxman Island (Leffingwell 1919). As an extension of the fifth Thule Expedition, Knud Rasmussen crossed into Alaska from Canada in 1924. He compiled ethnographic data on the Alaskan Iñupiat and their camps and recorded place names on the Utuqqaq (Utukok) River.

Missionary Efforts, Trading Posts, and Reindeer Herding

At the beginning of the twentieth century, whale oil and baleen decreased in importance as commodities on the world market. Mineral oils and distillates replaced whale oil for illumination and lubricants, and spring steel, early plastics, and changes in fashion made baleen a redundant product. The fur trade filled some of the economic gap left by the collapse of the whalebone (baleen) market and the subsequent demise of commercial whaling. The fur trading business in the area declined in the 1930s due to reduced fur demand during the Great Depression. Most of the trading posts ceased operations by the 1940s (Schneider and Libbey 1979).

Christian missionaries first arrived in Barrow in 1890. Mission schools were established between 1890 and 1910 at Wales, Point Hope, and Barrow, as well as other places that were not previously occupied year round. Eventually, the original mission schools split into separate entities: government schools and church-operated missions. Trading posts were also established near missions and schools. These areas became focal points for the Native population, and settlements grew up around some of these locations (Schneider and Libbey 1979).

At the end of the nineteenth century, Presbyterian missionary Sheldon Jackson introduced reindeer herding to Alaska Natives with government support. Reindeer herds were maintained by Iñupiat near Wainwright, Barrow, and Nuiqsut, as well as other settlements on the North Slope (Schneider and Libbey 1979). Reindeer herding ended in 1938 across much of the North Slope, partially due to the collapse of the market for meat and hides (Reanier 2002).

Military Presence

During the early part of World War II, the Alaskan Command had concerns about the possibility of Japanese troops invading mainland Alaska after their successful initial campaign into the Aleutians. To create an organized defense group, Major “Muktuk” Marston was assigned the task of organizing the Alaska Territorial Guard with units composed of Alaska Natives from central rural communities such as Point Hope, Barrow, Wainwright, Kaktovik, and Nome. The Alaska Territorial Guard was disbanded in 1946, with Colonel Marston resigning (Chandonnet 2008).

In the early 1950s, the U.S. and Canada, under threat of atomic warfare, planned a Distant Early Warning (DEW) Line that was to expand across the northern regions of Alaska and

Canada to provide advance warning for interception and counterattack of incoming heavy bombers from the Soviet Union (Denfeld 1994). Another system was the Aircraft Control and Warning (ACW) System, a set of relatively short-range radar sites completed before the DEW line using less sophisticated radar equipment, some dating back to World War II (Argonne National Laboratories 2001). The communications system designed to connect the network of DEW Line radars to the lower 48 was called White Alice (USACE 2001). The DEW Line-Alaska Segment has been found to be eligible for inclusion on the NRHP and the U.S. Air Force has documented two of the DEW Line sites for future historical research (Whorton 2002, ADNR, OHA 2011).

<u>Hydrocarbon Exploration, Production, and Development</u>

The Iñupiat have known of oil and gas on the North Slope for generations, well before European explorers and U.S. Geological Survey (USGS) researchers began reporting oil seeps in the mid-nineteenth and early twentieth century (Haycox 2009, Brower 1994, Leffingwell 1919, Ebbley and Joesting 1943). By the early 1920s, commercial interests began surveying the North Slope and staking mineral claims for oil in the region (Smith et al. 1926). In 1923, President Warren Harding set aside a large tract of land on the North Slope as the fourth Naval Petroleum Reserve (NPR4), intended to secure petroleum to supply Navy ships that had switched from coal to petroleum as fuel. The USGS conducted a preliminary geological survey of the region from 1923 to 1926 (Smith and Mertie 1930). In 1943, the Bureau of Mines sent a party to investigate the region's known oil seeps with Simon Paneak, then of Chandler Lake, as their guide (Ebbley and Joesting 1943). In 1944, the U.S. Navy returned to further survey NPR-4 and discovered a number of oil and gas deposits in the reserve (Reed 1958). Private companies continued the search for commercially exploitable oil and gas deposits, culminating with Atlantic Richfield Company (ARCO)'s discovery of the Prudhoe Bay field in 1968 (Naske and Slotnick 1994). The resulting rush by several companies to produce oil from the massive field and bring it to market through construction of the Trans-Alaska Pipeline System (TAPS) required groundbreaking federal legislation, investment, and engineering work to build infrastructure to support production and transportation of the crude oil (Roderick 1997).

The initiation of petroleum development has led to intensive investigations of cultural resources on the North Slope. These investigations occurred after World War II in the Naval Petroleum Reserve No. 4 (now designated the NPR-A), and before and during construction of the TAPS. The NSB Commission on History and Culture initiated the traditional lane use inventory for the North Slope in the 1970s in anticipation, of and in response to, increased resource development on the North Slope (Schneider and Libbey 1979).

Previously Reported Cultural Resources in the Proposed Project Area – North Slope Region

There are 178 previously reported AHRS sites located within 1 mile of the proposed Project area in the North Slope region; a total of 9 AHRS sites are located within the construction ROW. The sites that exist within the ROW are prehistoric and historic or a combination of multiple time periods. Included are lithic scatters and isolated flakes, faunal remains, and historic built-environment resources i.e., aboveground structures as opposed to buried cultural deposits.

Also previously reported are the Dalton (PSM-00570/SAG-00097/XBP-00114) and Hickel (SAG-00098) highways. None of the 9 previously recorded AHRS sites located within the construction ROW have undergone determinations of eligibility for the NRHP. The TAPS and the oilfield are potentially eligible historic properties that have not yet been evaluated for inclusion on the NRHP; however, these properties constitute an important historic theme for the region (BLM 2002). The Dalton Highway is currently treated as eligible under the Alaska Highway System Roads Programmatic Agreement, until a formal determination of eligibility can be made following completion of the Historic Roads context for Alaska (DOT&PF 2010).

TABLE 5.13-2 Previously Reported AHRS Sites within the Proposed Project Area ROW – North Slope Region

AHRS	Site Name	Period	Site Description	Preservation Status
PSM-00172	PSM-00172	Prehistoric	Site: Isolated find	NDE
PSM-00192	PSM-00192	Prehistoric	Site: Activity area; Lithics, Faunal remain	NDE
PSM-00476	PSM-00476	Prehistoric	Site: Lithic scatter; Flakes, Bone fragments	NDE
PSM-00534	PSM-00534	Prehistoric	Site: Isolated find, Flake	NDE
PSM-00570	Dalton Hwy (MP 1 to 414)		Site	NDE
SAG-00006	SAG-00006	Prehistoric/ Historic	Site	NDE
SAG-00097	Dalton Hwy (MP 1 to 414)		Site	NDE
SAG-00098	Hickel Highway		Site: Transportation; Winter road	NDE
XBP-00114	Dalton Hwy (MP 1 to 414)		Site	NDE

NDE – No Determination of Eligibility.
Sources: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

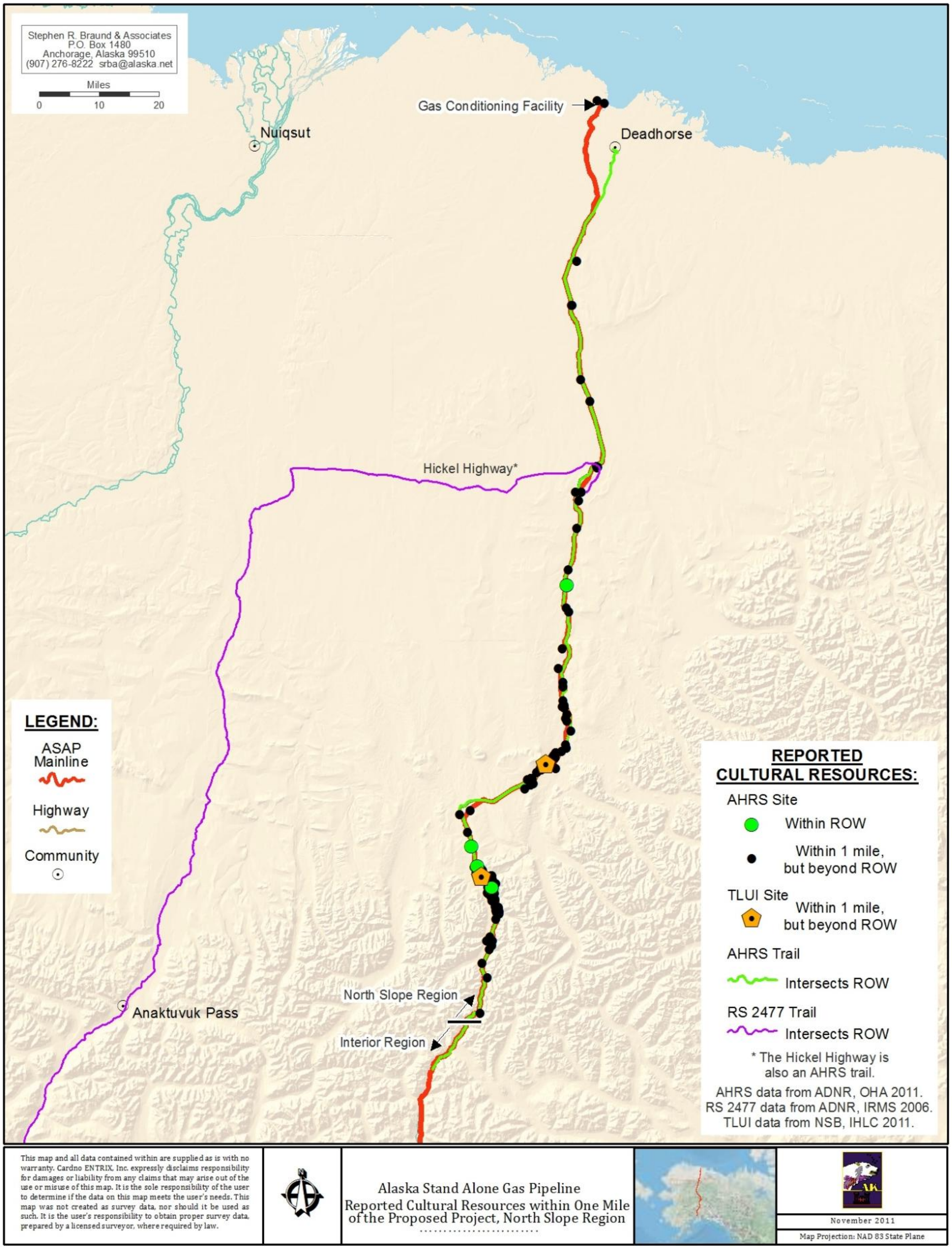

FIGURE 5.13-1 Reported Cultural Resources within 1 Mile of the Proposed Project – North Slope Region

There are two TLUI sites present within a mile of the proposed ROW in the North Slope region. Natvavak (TLUIPSM 006) represents a broad landscape of fishing, hunting, and trapping associated with Galbraith Lake and the surrounding mountains and drainages, including the Atigun area cultural resources sites listed by the AHRS. Grave Site No. 2 (TLUIPMS 014) is near a small lake on a raised bench west of the TAPS ROW. A description of TLUI sites within 1 mile of the proposed Project is provided in Table 5.13-3.

TABLE 5.13-3 Traditional Land Use Inventory Sites within 1 Mile of the Proposed Project

TLUI Key	TLUI Place	Site Description
TLUIPSM 006	Natvavak	Fishing, hunting, trapping, old settlement. Historical Site.
TLUIPSM 014	Grave Site No. 2	Old grave site.

Sources: NSB, Iñupiat History, Language, and Culture 2011; Stephen R. Braund & Associates 2011.

One RS 2477 trail is located in the North Slope region of the proposed Project area (Table 5.13-4). Portions of the Hickel Highway (RST 450, SAG-00098/BET-00201) are included in the North Slope and Interior regions of the proposed Project area.

TABLE 5.13-4 Previously Reported RS 2477 Trails within 1 Mile of the Proposed Project Area – North Slope Region

RS 2477 ID	RST Name	AHRS Number
RST 450	Hickel Highway	SAG-00098

Sources: ADNR, Information Resource Management Section (IRMS) 2006; Stephen R. Braund & Associates 2011.

Table 5.13-5 shows 1 AHRS site representative of the built environment located on the North Slope, within 1 mile of the ROW near the proposed GCF at the ARCO Prudhoe Bay Discovery Well site (XBP-00056), which is marked with an ARCO logo made from steel pipe. The North Slope region has the sparsest built environment of all the regions, with one TAPS system AHRS site standing.

TABLE 5.13-5 Built Environment Sites within 1 Mile of the Proposed Project Area by Historic Theme – North Slope Region

AHRS Number	Site Name	Theme
XBP-00056	Prudhoe Bay Oil Field Discovery Well	TAPS

Sources: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

5.13.2.2 Interior Region

Overview of Regional Prehistory (12,00 years ago to 1815 A.D.)

Beringia Period

Archaeologists have divided the prehistory of the Interior region of Alaska into distinct time periods (e.g., Beringia, Transitional, and Taiga), each with associated cultural traditions (Holmes 2008). The period prior to 13,000 years ago is termed the Beringian Period, when the region was still separated from the rest of North America by glaciers but connected to Siberia via Beringia, a vast plain later inundated to become the Bering Sea (Holmes 2001). The earliest cultural sites in this region (e.g., Swan Point, XBD-00156) date to this time period and are assigned to the East Beringian Tradition, which are characterized by a microblade and burin technology (Table 5.13-6). The Younger Dryas climate event separated the Beringian from the Transitional time period (13,000 to 9,500 years ago) and brought subsequent changes in climate and geography to the region. The land bridge with Siberia was lost as the Bering Sea inundated the connection between the continents, and by 13,000 years ago, an ice free corridor connected the Yukon drainages and Tanana River basin of Interior Alaska to the Midwest of the United States (Holmes 2001).

TABLE 5.13-6 Sequence of Interior Alaska Archaeological Cultures

Tradition	Subdivision	Date	Finds	Representative Sites
Euro-American		1780–to Present	Industrial manufactures, metal, glass, plastic.	Rika's Roadhouse, Fort Egbert, Alaska Railroad, TAPS
Athabascan		1,300 BP–1780 AD, continues to present	Lithics replaced by organic and copper tools. Bow and arrow replaces atlatl.	Gulkana, Dixthada
Northern Archaic		1,300–6,000 BP	Early period notched base points, later stemmed and oblanceolate points, few to no microblades.	XMH-035, -166,-219; Dry Creek Paleosol 4a; Swan Point CZ 1b; Kenai River SEW-214; Graveyard
Transitional Northern Archaic		6,000–8,500 BP	Microblades decline; notched base points appear.	Swan Point CZ2, Annie Lake, Canyon, Owl Ridge Component III
American Paleo-Arctic	Denali	11,500–8,500 BP	Wedge shaped microblade cores, burins, end scrapers, bifaces.	Campus Site, Donnelly Ridge, Swan Point CZ3, Owl Ridge Component II,
East Beringian Tradition	Chindadn, Nenana	14,000–11,500 BP	Teardrop shaped bifacial tools, triangular tools; microblades absent.	Owl Ridge Component I, Walker Road Component I
	Swan Point, Dyuktai		Microblades, burins.	Swan Point CZ4

BP – Before Present (i.e., years ago).
Sources: Holmes 2001, 2008; Peregrine and Ember 2001; Stephen R. Braund & Associates 2011.

Transitional Period

Two distinct cultural traditions from the Transitional Period include the end of the East Beringian Tradition and the American Paleo-Arctic or Denali Complex. The Healy Lake (XDB-00020), Swan Point (XBD-00156), and Gerstle River (XMH-00246) sites have microblades and burins, and were formerly grouped into the Denali Complex. Broken Mammoth (XBD-00131) and the Mead Site (XBD-00071) do not have microblades or burins and are considered by some to be part of a separate Eastern Beringian/Nenana Complex or Northern Archaic archaeological culture. What is clear is that during the Transitional Period were the beginnings of technological cultures distinct from their Siberian predecessors and adapted to regional climate, habitats, and game availability (Mason and Bigelow 2008). The sequence of prehistoric cultures is presented in Table 5.13-6.

Taiga Period

For the Holocene period, Holmes (2008) proposes a Taiga period with three chronological divisions: Early (9,500 to 6,000 years ago), Middle (6,000 to 3,000 years ago), and Late (3,000 years ago to contact). The Early Taiga period is characterized by the Transitional Northern Archaic. The Middle Taiga period is considered the ascendance of the Northern Archaic, marked by the presence of notched base points and associated with the spread of the boreal forest habitat. The Late Taiga period includes the florescence of the Athabascan Tradition at approximately 1,300 years ago (800 AD). The end of the Northern Archaic, and the shift to the Athabascan Tradition at 800 AD, is marked by a reduction in lithic technology use in favor of bone, antler, and copper materials;the disappearance of microblades and burins, and bow and arrow replacing the *atlatl* for hunting. Some have linked this sudden shift to a series of volcanic eruptions in the Wrangell–St. Elias Mountains between 20 and 720 AD. The volcanic event deposited a layer of ash over much of Interior Alaska and northwest Canada; this ash now serves as a prominent stratigraphic marker referred to as the White River tephra (Moodie et al. 1992). At the time of historic contact with Euro-Americans, Koyukon and Tanana-speaking Athabascan groups occupied the interior regions of Alaska located closest to the proposed Project area. The Koyukon people occupied regions adjacent to the lower and middle Yukon River, the Kantishna River as far as Lake Minchumina, and along the Koyukuk River to the south slopes of the Brooks Range mountains (McFadyen-Clark 1981). The traditional territory of the Tanana Athabascan tribe roughly corresponds with the Tanana River drainage and extends westward to the confluence of the Kantishna and Tanana rivers, north to the headwaters of the Tolovana River, and to the southeast to the northern slopes of the Wrangell Mountains (McKennan 1981).

Overview of Regional History

European and Euro-American Contact and Early Exploration

Early Russian forays into Interior Alaska may have begun in the late eighteenth century with expeditions overland from Lake Iliamna through the upper Kuskokwim River (Zagoskin 1967). Russians and Creoles working for the Russian American Company began exploring the Yukon River from the mouth in the early nineteenth century and proceeded up river as far as the confluence with the Tanana River. Russian expansion along the Yukon River was limited to the establishment of a few trading posts, the community of Nulato, and seasonal ventures upriver. Lieutenant Lavrentiy Zagoskin is the best known Russian explorer of interior Alaskan river systems during the Russian period, with an expedition from 1842 to 1844 that traversed Bristol Bay and the Kuskokwim and Yukon River valleys (Zagoskin 1967). In 1865, an American expedition sought to build an overland telegraph line for the Western Union and explored the Yukon from Saint Michaels to Fort Yukon (Whymper 1868, Dall 1870).

Trade, Military Exploration, and Resource Extraction

Early American influences in the interior region of Alaska likely included changes in the number and type of trade goods available to the people of the region in the 1850s. The U.S. purchase of Alaska in 1867 changed the ownership of the trading posts from the Russian America

Company to the Hutchinson, Kohl Company, later known as the Alaska Commercial Company (ACC). In 1883, the ACC won a fur price war on mainland Alaska thanks to a monopoly on Pribilof fur seal pelt sales. They subsequently purchased the competing Western Fur & Trading Company and Parrott & Company, acquiring the steamer Yukon in the purchase (Mercier 1986, Seeber 1889). These acquisitions effectively ended competition on the Yukon River for furs, causing prices to collapse, and fur trapping became less appealing to the residents of the area. Between 1880 and 1890, harvests dropped from 75,000 skins to 20,000 skins (VanStone 1979). Military exploratory parties traversed the Yukon River region, including the river rafting expedition of Lieutenant Schwatka in 1883, who later popularized the region through his lectures and articles in the popular press (Schwatka 1885a, 1885b, 1891, 1892). Exploration of the area continued in 1885 as part of an expedition led by Lieutenant Henry Allen of the U.S. Army (Yarborough 2000). The Army continued exploration along the Tanana, Copper, and Susitna rivers in 1898 (Glenn and Abercrombie 1899). The USGS also sponsored exploration that year into the Kuskokwim, Yukon, Copper, White, and other river systems (USGS 1899).

The 1897 discovery of gold in the Klondike created a mass movement of people into the interior of the Yukon Territory that spilled downstream along the Yukon River (VanStone 1979). The Klondike Gold Rush and subsequent rushes necessitated the establishment of government services in the interior of Alaska (VanStone 1974, 1979). Steamboats traveled the length of the Yukon and its tributaries, transporting prospectors to the next bonanza gold field. Captain E.T. Barnette established Fairbanks when the steamboat carrying his trading post supplies could go no further up the Tanana River due to low water levels, and thus established the trading post near the confluence of the Tanana and Chena rivers. The history of Fairbanks, its historic built environment resources, and landscapes are key elements of understanding the twentieth century history of the Yukon and Tanana River drainages (Matheson and Haldeman 1981).

Gold extraction took place in many areas surrounding Fairbanks, and a number of new towns boomed and busted. A railroad and road network were built to connect Fairbanks to mining towns in the general vicinity, such as Livengood, Chatanika, Birch Creek, Circle, Central, and several others. Trails and sled roads connected the riverboat port at Nenana with Fairbanks and the Goldstream and Chatanika valleys, and eventually to Livengood, Bettles, and other communities. Drift mining was the first means used to access placer gold in muck deposits under the permafrost. Later, steam and electric powered mechanical dredges would remove vast amounts of material and process it for gold (Reeves 2009).

Military and Government

The Alaska Road Commission, first under the military and later under the U.S. Department of the Interior, undertook the development and maintenance of overland routes of transportation, constructing roads, bridges, roadhouses and shelters, and navigational aids such as tripods and signs (Naske 1986). The trail from Valdez to Fairbanks allowed wagon, dog and horse sleds, and truck and car travel to Fairbanks and other Interior communities and supported roadhouses and ferries along the route. Trails with shelters and bridges were built and maintained from Nenana to Fairbanks, connecting those two major cities to the smaller communities Minto, Kantishna, Tanana, Livengood, Wiseman, and Coldfoot, as well as many other villages and camps (Naske 1986).

The Alaska Railroad (ARR) project (originally the Alaska Central Railway), began in 1903 at the newly established port of Seward (ARR 2010) and was a government project designed to link Interior Alaska with ice free ports on the Pacific Ocean. President Woodrow Wilson formed the Alaska Engineering Commission on March 12, 1914, which surveyed potential routes, and then purchased the bankrupt Alaska Northern and Tanana Valley railroads and proceeded to link and improve them. Construction began in 1915 at Anchorage, and the line was completed between Seward and Fairbanks by 1923, when President Warren G. Harding drove the golden spike at North Nenana on July 15th (Wilson 1977). The ARR supported coal mining at Healy and vicinity that continues to this day, as well as transporting fuel, supplies, and equipment for the Interior since its completion.

In 1939, just before World War II, an Army Air Base (Ladd Field) was built in Fairbanks on the Chena River (Price 2004). World War II brought a new wave of development to the interior section of Alaska. Road connections were established and improved, linking Fairbanks directly to the contiguous United States through Canada (Haigh 2008). Airfields were built along travel routes leading to Fairbanks, and from there along routes to Siberia and the Aleutians for Lend-Lease support of the Soviets, and to supply and defend Alaska from Japan following their invasion of the Aleutians (Dolitsky 2008). An Army air base (26 Mile Airfield) was constructed near Fairbanks, and the existing Ladd Field was expanded closer to town. Tracts of land in the region were set aside for training areas (Price 2004). The new road system and military presence brought a new level of economic prosperity to the interior region of Alaska, particularly following the construction of the Alaska Highway (Chandonnet 2008).

The Cold War brought further military exploration and development into all regions of Alaska. Nike missile sites were built to protect military bases in the Tanana basin, connected by communications systems that allowed immediate contact throughout the state and with command centers in the continental United States. Some of these facilities are still in use, such as the Clear AFB Ballistic Missile Early Warning System and other remote communications facilities, while many of the White Alice communications sites, Aircraft Control and Warning sites, and Forward Operating Bases have been removed (Price 2004).

Previously Reported Cultural Resources in the Proposed Project Area – Interior Region

There are 436 previously reported AHRS sites located within 1 mile of the proposed Project area in the Interior region; a total of 24 AHRS sites are located within the proposed Project ROW (Figure 5.13-2; Table 5.13-7). These sites include cultural materials from multiple time periods; a prehistoric archaeological district, prehistoric lithic remains, subsurface flakes, and a campsite; and historic sites associated with mining, the construction of the Dalton, Denali, and Hickel highways, the construction of the Alaska Railroad, and structures. One site (CHN-00025) has a nomination pending for the NRHP, 1 site (HEA-00062) has been determined eligible for the NRHP, and 2 sites (LIV-00040, LIV-00284) have been determined eligible as part of a NRHP nomination process, but not formally nominated (listed as “NCL” in Table 5.13-7). A total of 27 RS 2477 trails are located in the Interior region of the proposed Project area (Table 5.13-8). The Hickel Highway (RST 450, SAG-00098/BET-00201) includes portions located within the North Slope and Interior regions. AHRS properties listed as modern, historic, and protohistoric were examined for their contribution to a built environment and grouped according to historic themes in Table 5.13-9. Standing Interior region properties include 3 highway related properties, 44 ARR properties, 22 Cold War-era properties at Clear Air Force Station, 26 Gold Rush properties, and 25 properties in the Other Historic Theme category.

TABLE 5.13-7 Previously Reported AHRS Sites within the Proposed Project Area ROW – Interior Region

AHRS	Site Name	Period	Site Description	Preservation Status
BET-00121	BET-00121	Prehistoric	Site, Camp, Hearth, Firewood, Tci-tho	NDE
BET-00139	BET-00139	Prehistoric	Site, Lithic remains, Flakes, Reduction, Obsidian	NDE
BET-00200	Dalton Hwy (MP 1 to 414)		Site	NDE
BET-00201	Hickel Highway	Historic	Site, Transportation, Winter road	NDE
CHN-00025	CHN-00025	Historic	Site, Can scatter	NPD
CHN-00070	Dalton Hwy (MP 1 to 414)		Site	NDE
FAI-02102	Dunbar Trail		Site	NDE
HEA-00014	Coyote Creek Site	Prehistoric	Site, Isolated find	NDE
HEA-00015	HEA-00015	Prehistoric	Site, Lithics	NDE
HEA-00062	Nenana River Gorge Site	Prehistoric/Historic	Site, Lithics, FCR, Faunal, Pottery, Railroad	NRE
HEA-00091	Stampede Trail	Historic	Structure, Trail, Mining	NDE
HEA-00448	HEA-00448	Historic	Mining, Resource Utilization	NDE
HEA-00449	HEA-00449	Historic	Site, Mining, Resource Utilization	NDE
HEA-00450	Denali Hwy (MP 1 to 134.5)		Site	NDE
LIV-00040	LIV-00040 (Tolovana 1, Tolovana 2) [Rosebud Knob AD]	Prehistoric	Site, Activity area, Lithic remains	NCL
LIV-00284	Rosebud Knob Archaeological District	Prehistoric	District, Archaeological	NCL
LIV-00501	Dalton Hwy (MP 1 to 414)		Site	NDE
LIV-00556	Dunbar Trail		Site	NDE
PSM-00186	PSM-00186	Historic	Site	NDE
PSM-00188	PSM-00188	Historic/Modern	Site	NDE
PSM-00570	Dalton Hwy (MP 1 to 414)		Site	NDE
TAN-00118	Dalton Hwy (MP 1 to 414)		Site	NDE
WIS-00408	Dalton Hwy (MP 1 to 414)		Site	NDE
WIS-00020	WIS-00020	Prehistoric	Site	NDE

NDE – No Determination of Eligibility; NRE – Determined Eligible; NPD – Nomination Pending; NCL – Nomination Closed.
Sources: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

TABLE 5.13-8 Previously Reported RS 2477 Trails within 1 Mile of the Proposed Project Area – Interior Region

RS 2477 ID	RST NAME	AHRS Number
RST 119	Kobi–Bonnifield Trail to Tatlanika Crk	
RST 152	Nenana-Tanana (serum run)	
RST 1595	Dunbar-Minto-Tolovana	
RST 1602	Ester Dome-Nugget Creek Trail	
RST 1611	Bergman-Cathedral Mountain	
RST 1824	Alder Creek Trail	
RST 209	Bettles-Coldfoot	
RST 254	Wiseman-Chandalar	
RST 262	Caro-Coldfoot	
RST 264	Old Mail Trail (Nenana-Minto)	
RST 340	Lignite-Stampede	
RST 343	Kobi-Kantishna	
RST 344	Lignite-Kantishna	
RST 345	Kobi-McGrath (via Nikolai & Big River)	
RST 346	Nenana-Kantishna	
RST 412	Slate Creek	
RST 450	Hickel Highway	BET-00201
RST 468	Hunter Creek-Livengood	
RST 491	Rex-Roosevelt	
RST 591	Coldfoot-Junction Trail 49 (east route)	
RST 625	Cantwell Small Tracts Road (Lovers Lane)	
RST 66	Dunbar-Brooks Terminal	FAI-02102; LIV-00556
RST 70	Ester-Dunbar	
RST 707	Windy Creek Trails (Cantwell)	
RST 709	Healy-Diamond Coal Mine Dirt Road	
RST 899	Hammond River Trail	
RST 9	Coldfoot-Chandalar Lake Trail	

Sources: ADNR, IRMS 2006; Stephen R. Braund & Associates 2011.

TABLE 5.13-9 Built Environment Sites within 1 Mile of the Proposed Project Area by Historic Themes – Interior Region

AHRS Numbers	Site Names	Theme
HEA-00300, HEA-00302, HEA-00303, FAI-00074, FAI-00081, FAI-00089, FAI-00090, FAI-00092, FAI-00093, FAI-00095, FAI-00097, FAI-00098, FAI-00105, FAI-00225, FAI-00440, FAI-01555, FAI-01558, FAI-01728, FAI-01735, HEA-00068, HEA-00069, HEA-00072, HEA-00074, HEA-00075, HEA-00079, HEA-00084, HEA-00224, EA-00252, HEA-00280, HEA-00293, HEA-00301, HEA-00305, HEA-00326, HEA-00328, HEA-00337, HEA-00338, HEA-00350, HEA-00377, HEA-00380, HEA-00382, HEA-00383, HEA-00387, HEA-00427, WIS-00009	cabin, yanert mouth cabin (cabin #176), yanert coal mine, jap roadhouse, golden spike site, nenana river r.r. bridge, ferry r.r. station (residency 4, nenana river ferry village), tanana river r.r. bridge, arr bridge 422.9, arr bridge 432.1, arr bridge 439.7,arr bridge 447.7, nenana depot (nenana r.r. station), saulich homestead, alaska railroad bed, railroad cemetery north of nenana, historic cabin, old george hall, nenana river bridge at rex, cantwell r.r. section house, cantwell (cantwell r.r. station, cantwell river station), clear creek r.r. bridge, riley creek r.r. bridge, mckinley park station (mckinley park r.r. station), garner tunnel (tunnel 10), sheep creek r.r. bridge (arrc bridge 352.7), lower windy creek ranger cabin #15 [ptl cab], healy hotel, maurice morino grave, nenana canyon roadhouse and patrol cabin complex, lagoon section station (cabin #175), shed at oliver flag stop, ak r.r. bridge mp 351.4 unnamed trib of nenana river, hea-00328, chulitna river railroad bridge, bridge 305.7, railroad bridge, bridge 354.4, hea-00350, arr bridge 355.2 [arr bridge], arrc timber bridge mp 319.7, arrc timber bridge mp 337.0, arrc timber bridge mp 348.8, arrc timber bridge mp 369.7, healy school house (stickle home), slisco's roadhouse (jack flowers' roadhouse, wiseman roadhouse)	ARR
FAI-00569, FAI-00570, FAI-00571, FAI-00572, FAI-00573, FAI-00574, FAI-00575, FAI-00576, FAI-00577, FAI-00578, FAI-00579, FAI-00580, FAI-00581, FAI-00582, FAI-00583, FAI-00584, FAI-00585, FAI-00586, FAI-00587, FAI-00588, FAI-00589, FAI-01769	clear afs: building 101, transmitter building, building 102, transmitter building, building 103, supply and equipment warehouse, building 104, scanner building, building 105, scanner building, building 106, scanner building, building 110, thaw shed, building 111, electric power station, building 113, chemical storage, building 114, ash silo, refuse incinerator, building 115, coal transfer crusher house, building 118, locomotive shelter, building 121, fire station, building 125, water pump station, building 126, water supply, building 127, water supply, building 128, water supply, building 129, water supply, an/fps-50 radar, detection radar antenna screen, structure 735 as], an/fps-50 radar, detection radar antenna screen, structure 736 [cas], an/fps-50 radar, detection radar antenna screen, structure 737 [cas], utilitor	Cold War
FAI-00226, FAI-00388, FAI-00389, FAI-00390, FAI-00414, FAI-00415, LIV-00039, WIS-00007, WIS-00008, WIS-00038, WIS-00040, WIS-00050, WIS-00281, WIS-00290, WIS-00291, WIS-00384, WIS-00405	cabin ruins, gold creek cabin no.1 (arc shelter cabin), gold creek cabin 2 (ems 39-3/1/f), rainbow gulch log and sod house, chn-00021, wilcox drift mine complex, sheep creek cabin 2007-1, rainbow gulch cabin, fe dredge #6, strawberry joe nettleton's cabin, cabin #2, cabin #3 (cabin ruin #3), fairbanks exploration company camp, moose creek cabin, moose creek prospects, lost creek cabin, coldfoot , townsite (slate creek), wiseman historic district (nolan, wrights), wis-00038, coldfoot historic district, minnie creek mine shaft, jonas cabin (big jim's cabin, florence jonas cabin, klhabuk's cabin), minnie creek drift mine complex, larson creek cabin, frank miller cabin residence, wiseman cemetery	gold rush
FAI-01736, FAI-01767, LIV-00455	little goldstream creek bridge, moose creek bridge, yukon river bridge	highways
BET-00050, CHN-00013, CHN-00015, CHN-00016, CHN-00018, CHN-00041, FAI-00031, FAI-00039, FAI-00099, FAI-00169, FAI-00410, FAI-00442, FAI-00444, FAI-01554, HEA-00043, HEA-00188, HEA-00282, HEA-00289, HEA-00290, HEA-00291, HEA-00292, HEA-00306, PSM-00186, PSM-00187, PSM-00188	bet-00050, chn-00013 (as 040/1/c), arctic john etalook cabin, chn-00016 (ems 37-3/1d), chn-00018, john etalook's summer camp, saint marks mission, mv taku chief, st theresa's catholic church, strand family cemetery, powder keg road, fish camp and possible village site, agnes homeier house, older native cemetery north of nenana, cabin site, hea-00188, mcclarty/smith graves, old cantwell cemetery, jack river graves, jack secondchief grave, fanny's grave, johnny romanov cabin, psm-00186, psm-00187, psm-00188	other historic themes

Sources: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

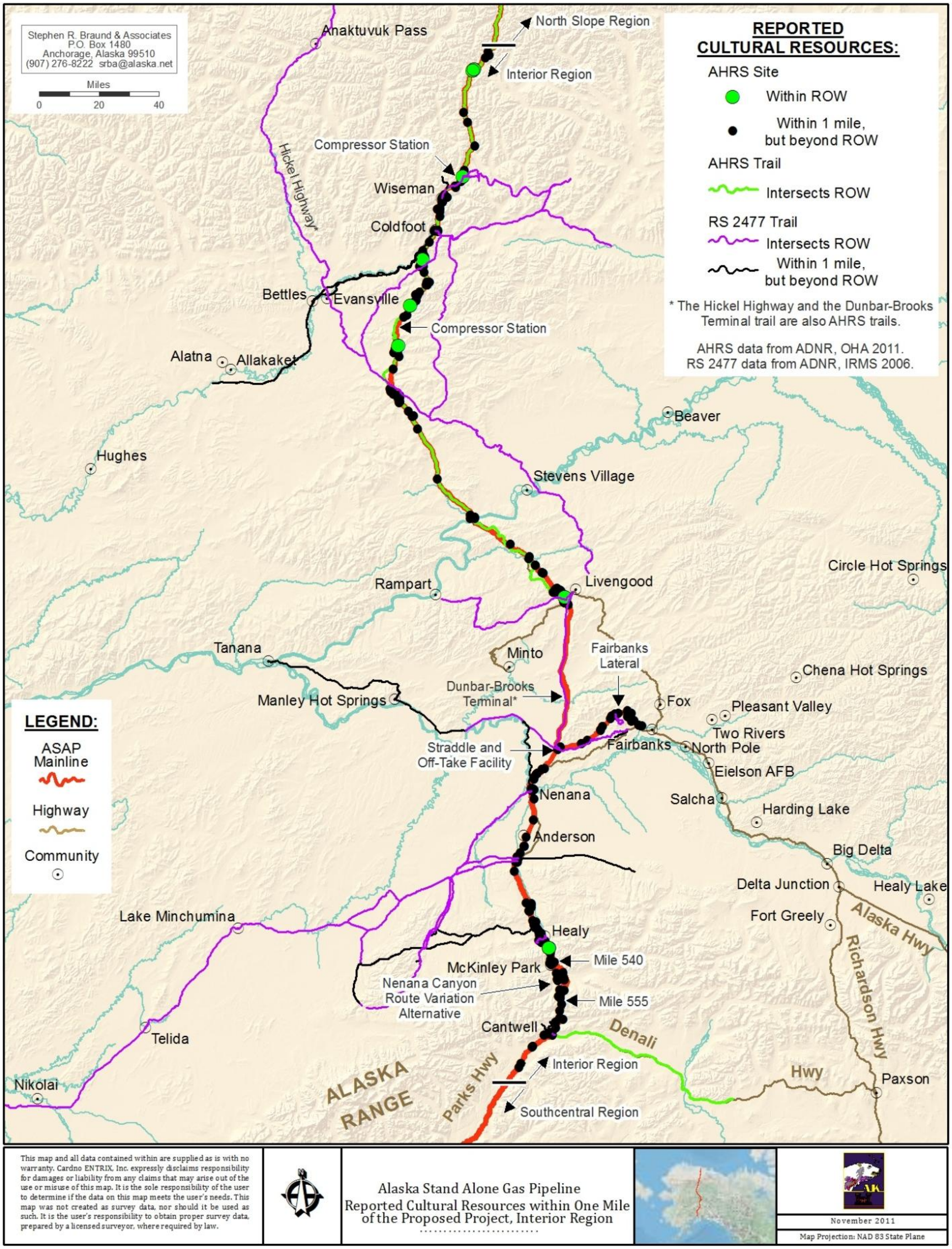

FIGURE 5.13-2 Reported Cultural Resources within 1 Mile of the Proposed Project – Interior Region

5.13.2.3 Southcentral Region

Overview of Regional Prehistory (12,000 years ago to 1815 A.D.)

Much of Southcentral Alaska, including the entire upper Cook Inlet trough, was glaciated repeatedly during the Quaternary Period – the most recent period of geologic time spanning from three million years ago to the present. Multiple sub-periods of glacial growth occurred in this period, with the Wisconsin era being the most recent. Before 12,000 years ago, the upper Cook Inlet was alternately covered by thick glacial ice masses or the marine waters from the North Pacific Ocean. Ice fields reaching up to 4,000 feet in depth covered the lowlands and valleys between the mountains surrounding the lower Susitna River and Matanuska River basins.

Early and Late Holocene

As the climate warmed, the ice sheets of the last ice age melted and the exposed lands were covered with pioneer vegetation dominated by low shrubs and other tundra plants. Glaciers continued to block the mountain passes ringing Cook Inlet until about 9,500 years ago, possibly affecting human and animal passage between Southcentral and Interior Alaska. After that time the mountain passes were ice free (Reger and Bundtzen 1990). The early prehistoric record of human activity in Southcentral Alaska has been documented at few locations (Table 5.13-10). Known sites include Beluga Point (ANC-00054) on Turnagain Arm (Reger 1996, 1998), sites in the Kenai Mountains (Reger and Pipkin 1996), several sites in the Matanuska Canyon (West 1996), and a series of sites along the upper Susitna River (Dixon et al.1985). These sites evidence an early core and blade technology in which stone blades were struck from a core material and later worked and retouched into finished form. There have been no Paleoindian sites found in Southcentral Alaska with diagnostic type artifacts such as fluted points (chipped tools notched near the base for hafting) and burins (stone tools with a characteristic flaked end used for engraving).

People using early core-and-blade technology likely hunted land animals in the Southcentral region. Elsewhere, core-and-blade technologies are found on the coast, probably the tools of marine-mammal hunters. Analogous to other radiocarbon dated sites in Alaska, Southcentral core-and-blade technologies date from 7,500 to 10,000 years ago (Reger 2003). The interpretation of the period after these core-and-blade occupations is not clear, probably because several different culture groups with various stone-tool technologies were in the area at the same time. Some 4,000–5,000 years ago, notched stone points were used in the upper Susitna River basin. Reger (2003) describes a “distinctive, stemmed, chipped stone projectile point and a high shoulder form of knife” from Beluga Point (ANC-00054) during this time. There are no slate tools—ground, polished, or pecked—in the core-and-blade assemblages.

TABLE 5.13-10 Sequence of Southcentral Archaeological Cultures

Tradition	Date	Finds	Representative Sites
Euro-American	1780–Present	Industrial manufactures, metal, glass, plastic.	ARR, Iditarod Dog Mushing Landscape, Matanuska Colony Farms, Independence Mine, Sullivan's Roadhouse
Chugach	800 BP–1780 AD, continues to Present	Polished slate projectiles, knives, spear points. Occurs contemporaneously with Dena'ina materials.	Beluga Point
Athabascan	1,500 BP–1780 AD, continues to Present	Lithics replaced by organic and copper tools. Bow and arrow replaces atlatl.	House and cache pit sites, *Ch'u'itnu* Archaeological District, Red Shirt Lake Village
Kachemak	3,000–1,400 BP	Grooved and notched pebble and cobble weights, toggling harpoon points, ground slate ulus, bone tools, cobble spall tools, adzes.	Yukon Island, Yukon Island Bluff, Yukon Fox Farm, Yukon Island West Beach, Cottonwood Creek, Merrill, Chugachik Island
Arctic Small Tool Tradition	4,000–3,000 BP	Burins, gravers, unifaces, abraders, small bifacial points, no ground slate.	Chugachik Island, Beluga Point North II
Late Ocean Bay	4,000–5,000 BP	Ground slate lance heads and knives, flaked projectile points, bifaces and unifaces, retouched flakes, stone wedges and cores.	SEW-0214, Sylva site, Beluga Point South I and North II
Late Mid-Holocene (Northern Archaic-like)	4,000–5,000 BP	Side notched points, uniface, cobble chopper.	SEW-0214, Beluga Point component South III
Early Holocene Core and Blade	10,000–5,000 BP	Wedge shaped microblade cores, burins, end scrapers, bifaces.	SEW-214, KEN-094, SEW-187, Long Lake, Beluga Point

BP – Before Present (i.e., years ago)

Sources: Workman 1996, Clark 2001. Stephen R. Braund & Associates 2011.

Kachemak

Approximately 4,200 years ago, people with ground slate spear points and knives camped at Beluga Point (ANC-00054) and probably in the Upper Yentna River Drainage (Dixon 1993, Reger 1981). Kachemak Culture people with a marine-oriented harvest technology spread over much of the Cook Inlet Basin during the period of 2,500- 1,000 years ago. The Kachemak Culture was comprised of Eskimo people that originated in the Kodiak Archipelago and was characterized by elaborate and distinctive burial practices, notched cylindrical stones, fishing hooks, and other utilitarian items that allowed them to harvest from a marine environment (Langdon 2002). Inland, the stratified Hewitt Lake (TAL-00049 and TAL-00050) site has a Riverine Kachemak component in the lower levels, while upper levels contain later Dena'ina components (Dixon 1996). Riverine Kachemak people relied on salmon harvests, as evidenced by numerous small, notched pebble net sinkers. Ground slate was used for ulus (semi-lunate knives) and spear points. Chipped stone arrow points are common in these assemblages (Clark 2001). These people were likely hunters and gatherers who followed game and plant resources with the seasons to support themselves.

Dena'ina and Chugach

The Dena'ina, an Athabascan-speaking culture, occupied the Southcentral area approximately 1,500 years ago and were characterized by semi-subterranean houses, tools of primarily bone and wood, and exploitation of both a marine and terrestrial subsistence environment (Reger 2003). Occupation and use of Southcentral Alaska was not confined solely to Dena'ina in the late prehistoric period. Levels at the Beluga Point (ANC-00054) site radiocarbon dated from 600 to 800 years ago show a Chugach Eskimo occupation with characteristic ground slate tools, polished adze bits, and stone scrapers left from repeated uses at this stopover locality (Reger 1981). The interplay of occupations and a long tradition of orally recorded accounts of both trade and conflict between the Dena'ina and various Eskimo descended groups of the Alaska Peninsula, Kodiak Archipelago, Prince William Sound, and Kenai Peninsula are recounted in several sources, including Kari and Fall (2003), Wrangell (1980), and Znamenski (2003). In the Upper Susitna Valley is an interface between the upper Cook Inlet Dena'ina-speakers and peoples who spoke Ahtna, Tanana, and Upper Kuskokwim languages. These contacts took place through a number of well-traveled passes through the Alaska Range Mountains (Kari and Kari 1982). The sequence of prehistoric to historic cultures is presented in Table 5.13-10.

Overview of Regional History

Russian America, 1740 to 1867

Early interactions in the late 1700s between the Dena'ina, the Russians, and other European groups were limited by the intense interest elsewhere in Alaska for sea otter pelts that were traded to China in exchange for tea, spices, chinaware, cotton, and silk. There were few sea otters in the Outer Cook Inlet and in Upper Cook Inlet when British explorers James Cook and George Vancouver visited in the 1770s (Beaglehole 1967, Vancouver 1967). French, British, Spanish, and American traders and explorers were encroaching on Russian territory by the 1790s. They traded for otter and other pelts both in the waters of the Pacific and inland, where the Northwest Company, Hudson's Bay Company, and other fur traders had trading posts.

With the sea otters depleted, the Russians began a period of otter management in their territory to rebuild the population. This shifted their trading efforts to land furs, especially beaver, but including mink, bear, river otter, moose, and caribou hides (Black 2004, Wrangell 1980). These were traded within Alaska, with Russians serving as go-betweens for trade between Indians and Eskimos, and with China and Britain. The Russian fur- trade companies designated local residents in each village to serve as managers for trade, or "toions," who kept track of the pelts stored for trade to the Russians and encouraged men to hunt for fur animals (Black 2004, Solovjova and Vovnyanko 2002). The Dena'ina used their central geographic position and network of trails to serve as middlemen traders between the Russians and the groups farther in the interior, gathering relatively great wealth in a short time (De Laguna 1934, Osgood 1937, Townsend 1981, Stafeev 1985).

From 1741 to 1838, Europeans inadvertently introduced the first of many epidemic diseases that devastated Native populations throughout the Arctic (Fortuine 1992). Smallpox, tuberculosis, measles, mumps, chicken pox, influenza, and other diseases would flare up and spread widely due to poor hygiene, wide travel, and winter crowding – killing perhaps more than half of all Native people in Alaska in one epidemic that started in 1838. Subsequent periodic epidemics caused numerous deaths and long-term debilitating illnesses, ameliorated in the 1840s with the first vaccines and in the 1940s with the introduction of antibiotics.

Early Settlement, 1867 to 1915

In 1867, the United States purchased Alaska from Russia. Under the Treaty of Cession, the Dena'ina were to be treated as semi-settled peoples, equivalent to contemporary Indians (Black 2004). However, during much of the early days of American administration there was no direct supervision or provision for government, schools, or other services. The U.S. Army had several small posts in Alaska, then the U.S. Navy administered the territory, and finally the Revenue Cutter Service – precursor to the U.S. Coast Guard – conducted court and provided medical care during cruises around the coast. Only after the first gold rushes in Canada, which spilled over into Alaska, was a territorial government formed to record land claims for mineral development (Bancroft 1886, Naske and Slotnick 1994).

The Gold Rush in the Klondike in 1898 was the first of several events that would change Alaska from an isolated, ignored outpost to an organized territory with allure for hunters, adventurers, and sportsmen. Government explorers like Herron (1901), Mendenhall (1900), Brooks (1911), and Glenn (1900) were accompanied by private explorers, hunters, and mountain climbers like Browne (1913), Hawthorne (McKeown 1951), and Studley (1911).

Gold prospecting created the next great influx of Euro-Americans into Upper Cook Inlet, beginning with discoveries on the Kenai Peninsula and Turnagain areas in 1891 (Buzzell 1986). Soon communities began to spring up to serve the provisioning needs of the Klondike and other gold rushes taking place throughout Alaska. In some cases, existing trading posts filled this need; in other cases, towns such as Knik (ANC-00036) and Susitna Station (TYO-00018) grew up along Cook Inlet (Potter 1967). The community of Knik (ANC-00036) was the largest settlement in the Matanuska-Susitna Valley in the 1890s. Knik (ANC-00036) served as a transfer point for passengers and freight from ocean-going steamers to smaller vessels or for overland travel. In response to the need for an overland route to connect Nome to the "Outside" during the winter months, and in light of recent gold discoveries over 200 miles to the northwest of Knik in interior Alaska's Innoko District, the Army appointed Walter Goodwin to blaze a trail in 1908 from Seward through Cook Inlet at Knik and on to Nome (BLM 1986). After the discovery of gold in 1909 in the Iditarod district, located just southwest of the Innoko district, this trail later became known as the Iditarod Trail. Traffic along the trail increased; as many as 120 mushers reportedly traveled through Knik in one week during November of 1911, bound for the interior districts. By 1914, an overland mail route passed through Knik from Seward to Nome. The establishment of Anchorage in 1915 as the Alaska Railroad construction headquarters and ship anchorage spelled the end of Knik's prosperity. By 1917, it was virtually abandoned (Potter 1967).

Establishing Government, 1915 to 1941

American government did not reach Upper Cook Inlet with any lasting authority until the 1915 establishment of Anchorage at the site of what was then known as Knik Anchorage at the mouth of Ship Creek. From here, the farthest point of navigability for ocean-going ships in Knik Arm, materials for construction of the Alaska Railroad were unloaded and barged to shore. Connections were soon built to existing rail lines of the former Alaska Northern Railroad in Turnagain Arm. The government, having purchased the failed private railroad to create the Alaska Railroad system, reached the coal fields of the Matanuska Valley, the ice-free port at Seward, and the interior river ports of Nenana and Fairbanks (Wilson 1977).

Increasing populations of European-Americans in the Upper Cook Inlet area made it correspondingly difficult for the Dena'ina to maintain their traditional land use patterns, because homesteaders, settlers, and farmers began to colonize the promising lands of the Susitna and Matanuska valleys. Following the construction of the railroad, the Federal Government subdivided lands for homesteads and farms, and, in the 1930s, began a New Deal-era program to resettle farmers from Minnesota to the area as a poverty reduction effort (Miller 1975). The 1930s saw two ethnographic and archaeological surveys of the Dena'ina conducted by Frederica De Laguna and Cornelius Osgood, with some observations by Aleš Hrdlička, who traveled through Alaska several times studying the physical anthropology of its Native and immigrant peoples (De Laguna 1934, 1996, Hrdlička 1943, Osgood 1937).

World War II and Statehood, 1941 to Present

The entry of the United States into World War II on December 7, 1941, caused far-reaching consequences throughout the Alaska Territory. Before the war, the federal government underestimated the Territory's strategic importance. By the end of the war, after the Japanese had attacked, occupied, bombed, and been routed from the Aleutian Islands, the federal government better understood the Territory's location and importance. Tens of thousands of military personnel served in the Territory, dozens of airfields were built, the AlCan (Alaska) Highway was constructed, and billions of dollars were spent on other civilian and military projects (Bush 1984). Alaska officially became the 49th state on January 3, 1959.

After World War II, concerns about the USSR's ability to attack the continental U.S. by flying over Alaska and Canada led to a series of developments designed to defend against such an occurrence. Early radar stations and communications systems were inadequate to defend this frontier, so a system of Airborne Control and Warning stations was constructed with headquarters in Anchorage. This developed into the Pine Tree and Distant Early Warning systems, which communicated with Anchorage via the White Alice radio telephony system (Denfeld 1994, 2001). Nike missile bases Summit, Point, and Tare were built on Mount Gordon Lyon, at Point Woronzof, and Goose Bay - ringing Anchorage to provide defense against aerial attack. The effect of this was a level of development in Anchorage that was similar to that during World War II, as construction and support of Cold War defense installations blossomed and continued through the 1990s (Fried and Windisch-Cole 2006).

The hydrocarbon industry had major economic effects on Southcentral Alaska. Starting with the 1957 discovery of oil on the Kenai Peninsula, several major oil production companies built their headquarters in Anchorage. Beluga, on the north shore of Cook Inlet, became a center for gas production and power generation in the 1960s and 1970s. Construction of the Parks Highway in 1973 connected Anchorage to the Susitna Valley, Denali National Park, and ultimately to Fairbanks. By the 1980s, Anchorage was the center of activity in the state of Alaska (Tower 1999).

Previously Reported Cultural Resources in the Proposed Project Area – Southcentral Region

There are 90 previously reported AHRS sites within 1 mile of the proposed Project area in the Southcentral region; 6 AHRS sites are located within the proposed Project ROW (Figure 5.13-3, Table 5.13-11). These sites are mostly from the historic time period, and only the Iditarod Dog Sledding cultural landscape has been evaluated for inclusion on the NRHP and been determined eligible. Sites that are located within the ROW include 4 roads/trails and one bridge. Six RS 2477 trails are located within 1 mile of the proposed Project area (Table 5.13-12). The Southcentral region has 33 AHRS properties with standing modern, historic, or protohistoric eras listed (Table 5.13-13). These 33 include 3 Highway properties, 22 ARR properties, and 8 in the Other Historic Theme category. In the Southcentral region the Other Historic Theme properties include a cemetery and a grave site with built elements, a barn, and a number of cabins.

TABLE 5.13-11 Previously Reported AHRS Sites within the Proposed Project Area ROW – Southcentral Region

AHRS	Site Name	Period	Site Description	Preservation Status
TAL-00117	Petersville Road	Historic	Structure: Wagon road	NDE
TYO-00084	Knik–Rainy Pass Trail [INHT-PT]	Historic	Site, Trail, INHT	NDE
TYO-00110	Little Willow Creek Bridge	Historic	Structure, Bridge, Transportation, Road	NDE
TYO-00170	Trail		Site	NDE
TYO-00184	Trail		Site	NDE
TYO-00203, ANC-03326	Iditarod Dog Sledding Cultural Landscape	Historic	Network of historic dog mushing trails and destinations	NRE

NDE – No Determination of Eligibility.

NRE – Determined Eligible.

Sources: ADNR, OHA 2011; ADNR, OHA 2010; Stephen R. Braund & Associates 2011.

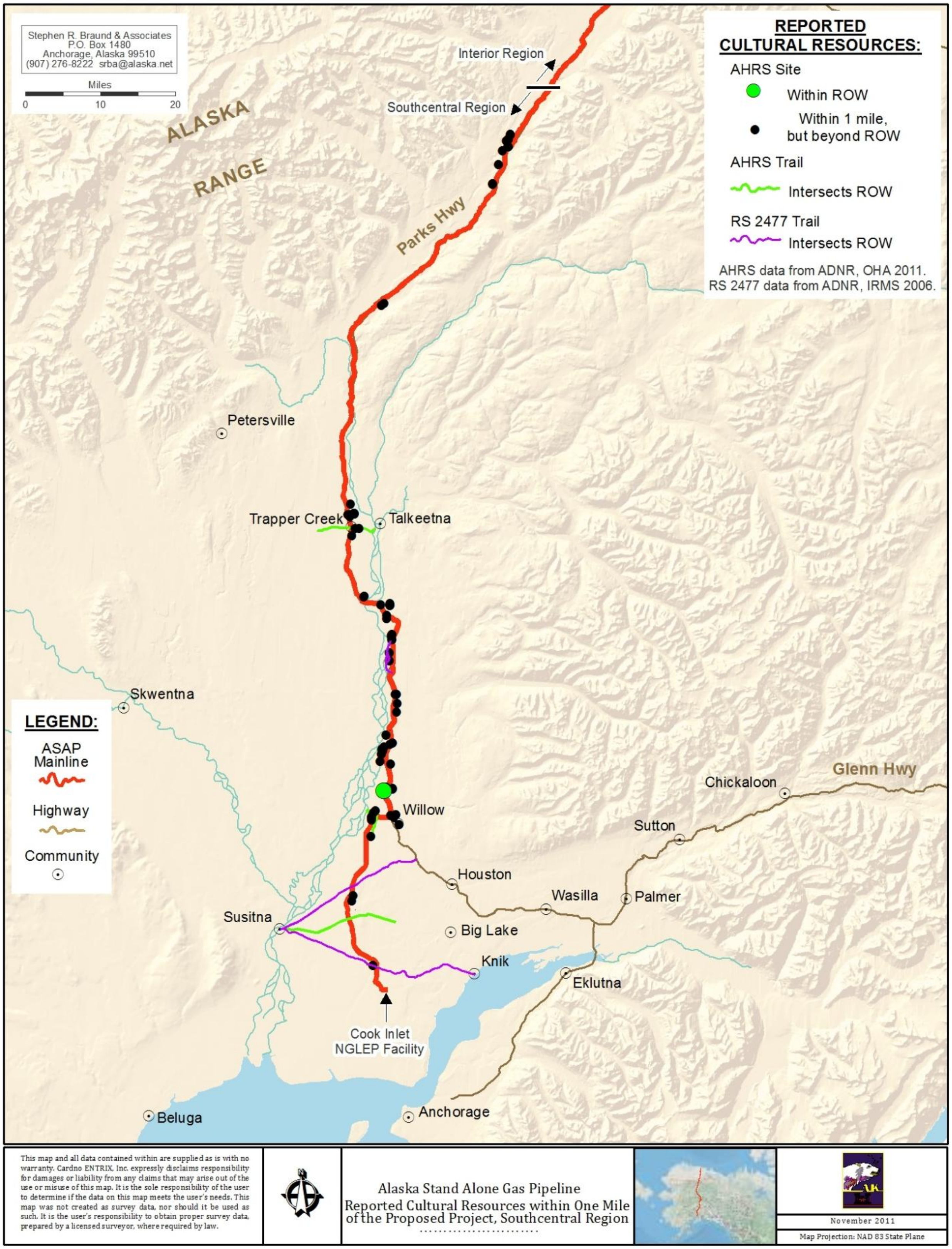

FIGURE 5.13-3 Reported Cultural Resources within 1 Mile of the Proposed Project – Southcentral Region

TABLE 5.13-12 Previously Reported RS 2477 Trails within 1 Mile of the Proposed Project Area – Southcentral Region

RS 2477 ID	RST NAME	AHRS Number
RST 118	Knik–Susitna	TYO-00084
RST 149	Nancy Lake–Susitna	
RST 1506	Goose Creek Road	
RST 1691	Herning Trail–Question Creek	
RST 52	Chulitna Trail	
RST 536	Montana Loop Trail	

Sources: ADNR, IRMS 2006; Stephen R. Braund & Associates 2011.

TABLE 5.13-13 Built Environment Sites within 1 Mile of the Proposed Project Area by Historic Themes – Southcentral Region

AHRS Numbers	Site Names	Theme
HEA-00054, HEA-00063, HEA-00325, HEA-00378, HEA-00419, HEA-00422, HEA-00423, TAL-00011, TAL-00012, TAL-00041, TAL-00061, TAL-00065, TAL-00066, TLM-00008, TLM-00277, TYO-00026, TYO-00027, TYO-00031, TYO-00038, TYO-00096, TYO-00097, TYO-00110	SULLIVAN'S ROADHOUSE, HURRICANE GULCH R.R. BRIDGE, ARR BRIDGE 287.7 HONOLULU CREEK [ARR BRIDGE], ARRC TIMBER BRIDGE MP 287.3, ARRC BERM, ARRC CABIN, ARRC TELEGRAPH SEGMENT, MONTANA CREEK R.R. BRIDGE, SUNSHINE R.R. SECTION HOUSE, SUNSHINE AREA HISTORIC CABIN, FRANK ARNOLD HOMESTEAD CABIN, KIRSCH/SPERLING/KLUBERTON LODGE AT SUNRISE AND CEMETERY, KIRSCH'S PLACE (THARE/ KIRSCH/ KLUBERTON CABIN), HURRICANE R.R. STATION, ARRC TIMBER BRIDGE MP 281.1, WILLOW CREEK R.R. BRIDGE, LITTLE WILLOW CREEK R.R. BRIDGE, SHEEP CREEK R.R. BRIDGE, WILLIAM DAVIS HOMESITE (JOHNSON HOMESTEAD, LITTLE WILLOW HOMESITE), AK R.R. MP 187.7 IRON CREEK BRIDGE (WILLOW CREEK BRIDGE), AK R.R. TRESTLE BRIDGE MP 200.9 CASWELL CREEK, LITTLE WILLOW CREEK BRIDGE	ARR
TAL-00125, TYO-00111, TYO-00112	MONTANA CREEK BRIDGE, KASHWITNA RIVER BRIDGE, SHEEP CREEK BRIDGE	Highways
TAL-00031, TAL-00076, TAL-00119, TAL-00130, TAL-00146, TAL-00147, TAL-00148, TYO-00093	MONTANA CREEK CEMETERY & SITE, RABIDEAU CABIN, BYERS LAKE CABINS, BELL'S BARN, CRUME HOUSE, CABIN, RUSSIAN ORTHODOX GRAVE, SUSITNA RIVER TRAPPER CABIN RUINS	Other Historic Theme

Sources: ADNR, OHA 2011; Stephen R. Braund & Associates 2011.

5.13.3 Environmental Consequences

The area of potential effects is defined in the Section 106 regulations as: "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16[d]).

The AGDC is conducting a concurrent process of cultural resources field surveys to identify, evaluate, and document historic properties within the ROW (a 90-meter [300-ft] corridor centered on the proposed pipeline centerline) to comply with the NHPA. The NHPA Section 110 requires federal agencies to identify, evaluate, inventory, manage, and maintain historic properties in their jurisdictions and those not under their jurisdiction or control but potentially affected by agency actions. Section 106 of the NHPA states that agency heads shall take into account the effects of agency actions, including agency undertakings and non-agency undertakings that require agency licenses to "take into account the effects of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." Section 106 requires agency heads to seek comment on the effects of undertakings from the Advisory Council on Historic Preservation, and Section 110 requires the head of a federal agency to consult with federal, state, and local agencies, Indian tribes, Native Hawaiian organizations, and the interested public in identifying, evaluating, and considering effects of an undertaking upon historic properties.

An adverse effect to a cultural resource occurs when an undertaking may alter, directly or indirectly, any of the characteristics of a cultural resource that could qualify the property for inclusion in the NRHP in a manner that would diminish the property's integrity (location, design, setting, materials, workmanship, feeling, association), and/or association (i.e., association with an important event or person [Criteria A and B], style of architecture [Criterion C], or information potential [Criterion D]) thus rendering it ineligible for the NRHP.

For this analysis, direct effects are those that occur within the ROW and footprint of proposed Project components (direct Area of Potential Effect [APE]). Examples of direct effects to cultural resources from ongoing or proposed activities could include physical destruction of, or damage to, all or part of the resource, removal of the resource from its original location, change of the character of the resource's use or of physical features within the resource's setting that contribute to its historic significance, change in access to traditional use sites by traditional users, or loss of cultural identity with a resource.

Indirect effects to cultural resources include those impacts that result from the action later in time or further removed in distance but still reasonably foreseeable. The geographic area within which the proposed Project could indirectly alter the character or use of a cultural resource was set at 1 mile (indirect APE) on either side of the ROW centerline. One mile broadly encompasses the maximum extent for visual elements that have the potential to diminish the integrity of a property's significant historic features, particularly in areas of low vegetation and flat topography. Other indirect alterations would typically have the potential to alter the character or use of a cultural resource much closer to the ROW centerline than 1 mile. Such indirect alterations could be caused by the introduction of vibration, noise, or atmospheric elements, neglect of a property that causes its deterioration, transfer, lease, or sale out of federal ownership without proper restrictions, vulnerability to erosion, and increased access to and proximity of proposed Project components to culturally sensitive areas. Increased access could result in a greater vulnerability of cultural resources to intentional and inadvertent damage caused by the general public or by proposed Project personnel and equipment during construction and operation. Changes to stream banks, flow patterns, and erosion characteristics at stream crossings can cause erosion damage to cultural resource sites in the vicinity of the stream and floodplain. These indirect and direct APEs may be modified following consultation under the NEPA and the NHPA with interested parties, Alaska Native tribes, local governments, and state and federal agencies.

5.13.3.1 Assumptions

The following three assumptions governed the assessment of effects:

- All cultural resources in the study area are assumed to be National Register eligible unless otherwise specified;
- If an aspect of the proposed Project would negatively affect any of the characteristics of a cultural resource that qualify it or make it eligible for inclusion on the National Register (e.g., diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association), that would be an adverse effect. An adverse effect could be direct or indirect; and
- All unsurveyed areas of the proposed ROW could contain cultural resources eligible for listing on the National Register, and surveyed areas could have buried archaeological sites that are eligible but undiscovered.

5.13.3.2 No Action Alternative

No direct or indirect effects would occur to cultural resources within the ROW or within the 1-mile perimeter of the proposed Project area were the proposed Project not undertaken.

5.13.3.3 Proposed Action

Pipeline Facilities

Mainline

The construction ROW would be approximately 100 feet wide. For tundra, normal and rock ditching approximately 40 feet of the ROW would be used for storing sediment from the 10-foot wide pipeline excavation; on the opposite side of the excavation, 25 feet would be used for ditching and pipelaying equipment and 25 feet for vehicles to deliver pipe and supplies. Hillsides along the ROW would be built up with gravel for work pads and ROW preparation, while others would be graded out of the slopes they cross and in some cases would have wider ROW widths than those on flatter ground (AGDC 2011). The pipeline itself would be buried 6 feet below grade with the topsoil and spoils from the ditch stored on the opposite side from the work pads, then replaced over the pipeline (e.g., Baker 2009: Attachment 2). Operation and maintenance of the pipeline would include vegetation management, facilities security, and pipeline maintenance and inspection activities. These activities would take place periodically, with efforts to repair or prevent damage to the pipeline infrastructure as needed.

The following tables provide a summary of the number of previously reported cultural resource sites that may be potentially affected by construction and operation of the proposed Project. Table 5.13-14 shows the number of AHRS sites located within the proposed Project ROW (direct APE) and 1 mile of the ROW (indirect APE). Table 5.13-15 provides a list of RS 2477 trails that would either be crossed by the proposed Project ROW (within direct APE) or approach within 1 mile of the proposed Project (indirect APE).

TABLE 5.13-14 AHRS Sites within the ROW and 1 Mile of Proposed Project Segments

Pipeline Segment	AHRS Sites within proposed Project ROW	AHRS Site Number within proposed Project ROW[a]	AHRS Sites within 1 Mile	Built Environment AHRS Sites within 1 Mile
GCF to MP 540	31	BET-00121, 00139, 00200, 00201, CHN-00025, 00070, FAI-02102, HEA-00014, 00015, 00062, 00091, 00448, 00449, LIV-00040, 00284, 00501, 00556, PSM-00172, 00186, 00188, 00192, 00476, 00534, 00570, SAG-00006, 00097, 00098, TAN-00118, WIS-00408, 00020, XBP-00114	531	87[b,c]
Fairbanks Lateral	0		35	14[b]
MP 540 to MP 555	0		9	3[c]
Denali National Park Route Variation	0		12	10[c]
MP 555 to End	8	ANC-03326, HEA-00450, TAL-00117, TYO-00084, 00110, 00170, 00184, 00203	118	45

[a] For AHRS site descriptions, refer to Table 5.13-2, 7, 11.
[b] FAI-00095 included within 1 mile of Fairbanks Lateral and GCF to MP 540.
[c] HEA-00306 and HEA-00075 included within 1 mile of GCF to MP 540, MP 540 to MP 555, and Denali National Park Route.
Sources: ADNR, OHA 2011; Stephen R. Braund and Associates, 2011.

TABLE 5.13-15 RS 2477 Trails within the ROW and 1 Mile of Proposed Project Segments

Pipeline Segment	RS 2477 Crossed By Proposed Project ROW	ID / Name[a]	RS 2477 within 1 Mile but Not Crossed by Proposed Project ROW	ID / Name[a]
GCF to MP 540	15	RST 1595, 254, 262, 343, 345, 346, 412, 450, 468, 491, 591, 66, 70, 709, 9	8	RST 119, 152, 1611, 209, 264, 340, 344, 899
Fairbanks Lateral	4	RST 1595, 66, 70, 1602	1	RST 1824
MP 540 to MP 555	0		0	
Denali National Park Route Variation	0		0	
MP 555 to End	4	RST 118, 149, 1506, 625	4	RST 1691, 52, 536, 707

[a] For RS 2477 trail descriptions, refer to Table 4, 7, 10.
Sources: ADNR, IRMS 2006; Stephen R. Braund and Associates, 2011.

Gas Conditioning Facility to MP 540

This section of the pipeline that would extend from the Prudhoe Bay GCF to MP 540 roughly follows the TAPS route. For the GCF to MP 540 segment, there would be a total of 31 sites that could potentially experience direct effects from the proposed Project construction and 531 sites that fall within the area for potential indirect effects (Table 5.13-14). Fifteen RS 2477 trails would be crossed by the proposed Project within this segment, and an additional 8 would be within 1 mile, but not crossed (Table 5.13-15). Two TLUI sites would also be located within 1 mile of the proposed Project along this segment. There are 87 built environment AHRS sites within 1 mile of this segment, encompassing ARR structures and roadbed from Dunbar to MP

540; TAPS related elements; Gold Rush elements, including the Wiseman and Coldfoot districts; Highway bridges; and other built elements related to other historic themes, such as fur trapping and recreation.

Yukon River Crossing Options

Three options have been proposed for crossing the Yukon River: construct a new aerial suspension bridge (the Applicant's Preferred Option); utilize the existing E.L. Patton Bridge (LIV-00455) (Option 2); or utilize horizontal directional drill (HDD) methods to cross underneath the Yukon River (Option 3). The Applicant's Preferred Option and Option 3 would not result in impacts to cultural resources. Option 2 would directly involve a property (the E.L. Patton Bridge) on the Dalton Highway that is listed as eligible for the National Register. The E.L. Patton Bridge opened in October of 1975, and was named for a former Alyeska Pipeline Service Company president. The bridge was designed to allow for a natural gas pipeline crossing in the same structure where the TAPS line crosses the Yukon River (Magnus and Sun 2000). The pipeline infrastructure would hang below the bridge surface and would not result in additional impacts to known cultural resources, but could potentially impact previously unknown cultural resources.

MP 540 to MP 555

This section of the proposed Project would diverge from the Parks Highway at pipeline MP 540 and continue southeast of the Nenana River, approximately parallel to an existing power line ROW, crossing Lynx Creek, Montana Creek, and Yanert River en route to MP 555. There are no previously reported sites or RS 2477 trails that could potentially experience direct effects from the proposed Project construction along this pipeline segment (Table 5.13-14 and Table 5.13-15). Nine previously reported sites fall within the area for potential indirect effects. The Yanert Mouth Cabin (HEA-00302), Johnny Romanov Cabin (HEA-00306), and McKinley Park Station (HEA-00075) are the only standing built AHRS sites along this route segment.

MP 555 to End

Construction would be conducted along the George Parks Highway ROW. The proposed route leaves the Parks Highway ROW at MP 707 and proceeds south around the Nancy Lakes State Recreation Area, along an elevated glacial feature, to arrive at the junction with the Beluga Pipeline near the northernmost farm fields of the Point MacKenzie area. Much of this corridor has never been surveyed for cultural resources beyond the small samples surveyed for the proposed Project and other projects in the Point MacKenzie vicinity. For the MP 555 to End segment, there are a total of 8 previously reported sites that could potentially experience direct effects from the proposed Project construction and 118 sites that fall within the area for potential indirect effects (Table 5.13-14). Four RS 2477 trails would be crossed by the proposed Project within this segment, and an additional four would be within 1 mile, but not crossed (Table 5.13-15). The Iditarod Dog Sledding Cultural Landscape (ANC-03326 and TYO-00203), a historic district determined eligible for the NRHP, is also located in this region and extends from the east bank of the Susitna River, east to Point MacKenzie and Knik, and north to the Parks Highway, including Houston and the area just north of Willow. The cultural landscape consists of winter dog sledding trails and other properties related to the history of dog mushing in the area. AHRS sites from the built environment include ARR structures, highway bridges, and AHRS sites from other historic themes including fur trapping cabins and several cemeteries or burials.

Construction

Direct Effects

The construction phase would be the most likely to disturb reported and undiscovered cultural resource sites in the proposed Project ROW. Often the extent of reported archaeological sites is poorly defined, and sites discovered before GPS systems were available are imprecisely located (BLM 2002). Not all areas of the proposed Mainline have been surveyed for archaeological, historic, or other categories of cultural resources. However, AGDC plans to have the entire mainline surveyed prior to construction. Unanticipated site discovery may occur as pipeline excavation penetrates surface sediments more deeply than archaeological testing typically can achieve. A plan for procedures in the event of unanticipated discovery of cultural material and human remains should be in place prior to proposed Project mobilization.

Placement of gravel for work pads and spoil and subsequent demobilization of gravel pads and replacement of spoil could disturb or dislocate buried artifacts, features, and possibly human remains. Operation of heavy equipment over wet tundra, water saturated soils or incompletely frozen wet tundra, even with tundra mats, could cause displacement of buried archaeological deposits. Historic built-environment resources and artifacts are generally more easily identified and less likely to be damaged or disturbed during construction activities. Culturally modified trees and elements of cultural landscapes associated with subsistence, trapping, and travel across the landscape in prehistoric and historic periods may be damaged or removed. RS 2477 trails may be obstructed or rerouted around construction activity, adversely impacting their historic integrity. Activity along the ROW and soil displacement may adversely affect cultural landscapes and Traditional Cultural Properties (TCPs). Construction could block contributing trails in the dog sledding landscape for the duration of construction operations. Built-environment AHRS sites in close proximity are mainly ARR bridges; other built elements are more than 1,000 feet from the ROW.

Indirect Effects

Increased human presence and activity on the ROW during the construction phase would likely result in the location of reported, and previously undiscovered, cultural resource sites in and along the ROW, which could result in a greater vulnerability of cultural resources to damage or looting. Open cut crossings on streams may cause changes in stream banks, resulting in bank cutting or channel infill, potentially exposing, eroding, or flooding cultural resource sites.

Operations and Maintenance

Direct Effects

Maintenance and operation of the pipeline ROW would result in a pathway ranging from 30-feet wide on non-federal lands to 52 feet wide on federal lands covered with low, shallow rooted vegetation. This vegetation may be maintained with a variety of methods including herbicides, manual vegetation management, and selective re-vegetation using native species selected for their low-level growth and shallow root systems. Aboveground facilities are addressed under specific sections below.

Contributing trails to the historic dog sledding landscape, including RS 2477 trails, may be obstructed or rerouted by surface infrastructure, such as access control points and fences, causing the trail to lose its historic integrity, although these effects are likely minimal and easily mitigated due to the small footprint of aboveground facilities in the area. Additional traffic and use of these trails may also result, as the pipeline ROW will be cleared of vegetation, and will create additional access to a well-used recreational trail system with historic trail elements and thus enhancing its value to the community. Product spills, modifications or changes to the pipeline and possible future upgrades to the pipeline system could result in direct effects through displacement of reported or undiscovered cultural resource sites.

Indirect Effects

Indirect effects would likely include increased access by the public to the ROW and adjacent lands, which could result in a greater vulnerability of cultural resources to damage or looting. Visual impacts to the landscape would include the linear feature of the cleared ROW, with periodic indications of the presence of the pipeline where it surfaces, which may be intrusive to a potential cultural landscape.

Fairbanks Lateral

The Fairbanks Lateral would connect the main stem of the pipeline near the former Dunbar ARR station to Fairbanks along the ARR ROW, with a small section at Sheep Creek Road briefly diverging from the ARR ROW. For the Fairbanks Lateral, there are no reported sites that could potentially experience direct effects from the proposed Project construction and 35 sites that fall within the area for potential indirect effects. Four RS 2477 trails would be crossed by the proposed Project within this segment and 1 additional trail is within 1 mile, but not crossed. There are 14 built-environment AHRS sites within 1 mile of the ROW, including ARR, Gold Rush, and Highway related properties.

Construction

Direct Effects

Direct effects from construction of the Fairbanks Lateral would be the same as those described above under “Mainline.”

Indirect Effects

Indirect effects from construction of the Fairbanks Lateral would be the same as those described above under “Mainline.”

Operations and Maintenance

Direct Effects

Direct effects from operations and maintenance of the Fairbanks Lateral would be the same as those described above under "Mainline."

Indirect Effects

Indirect effects from operations and maintenance of the Fairbanks Lateral would be the same as those described above under "Mainline."

Aboveground Facilities

<u>Gas Conditioning Facility</u>

Construction of the GCF would require a gravel pad covering approximately 70 acres of tundra near existing facilities. No reported cultural resource sites are located within the proposed construction footprint. Two sites are located within the area for potential indirect effects. The monument built on the Prudhoe Bay Oil Field Discovery Well site (XBP-00056) is visible from the proposed location.

Construction

Direct Effects

No reported cultural resource sites would be located within the proposed construction footprint. Construction could affect undiscovered cultural resource sites in the GCF footprint.

Indirect Effects

An increased number of people would be active on the landscape at the time of construction, increasing the likelihood that the two nearby cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be expected from operation and maintenance of the GCF.

Indirect Effects

No indirect effects would be expected from operation and maintenance of the GCF. The GCF would represent a small, incremental addition to the existing array of facilities of similar appearance and purpose in the Prudhoe Bay area and thus would not be an incompatible visual and architectural element on the landscape.

Compressor Stations

One to two additional compressor stations could be necessary. If one only is needed, it would be located at MP 285.6, near the Prospect Camp. If two are needed they will be at MP 225.1, north of Wiseman, and MP 458.1, at the straddle and off-take facility. Construction would require 1.4acre parcels along the pipeline ROW and the placement of large equipment in a modular structure. No reported cultural resource sites would be located within the proposed construction footprints. Six previously documented sites are located within 1 mile of the potential Wiseman compressor location and 1 site within 1 mile of the Prospect Camp compressor station. Impacts from the potential compressor station located at the straddle and off-take facility are discussed under the “Straddle and Off-Take Facility” section.

Construction

Direct Effects

Construction could affect undiscovered cultural resource sites in the compressor station footprint.

Indirect Effects

An increased number of people would be active on the landscape at the time of construction, increasing the likelihood that nearby cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be expected from operation and maintenance of the compressor stations.

Indirect Effects

Operation of the compressor stations would create noise and could present a visual adverse effect in the rural environments they would occupy. Noise and activity near the potential Wiseman compressor location could affect the integrity of the 6 cultural resources in that vicinity. The structure housing the compressor and other equipment could be an incompatible visual and architectural element on the landscape. Collocation of facilities with other facilities would reduce the overall visual impact by concentrating those effects in one location.

Straddle and Off-Take Facility

The straddle and off-take facility would require a 3.3 acre pad. Two previously documented sites are located within the footprint of the potential zone for the facility. The Dunbar Railroad Station site (FAI-00008) and the Dunbar roadhouse site (FAI-00075) are located in this potential footprint. The structures associated with these sites are alleged to have been removed by the ARR (AES 2011).

Construction

Direct Effects

Construction could affect the integrity of the two sites within the potential zone, as well as any other undiscovered cultural resource sites in the straddle and off-take facility footprint.

Indirect Effects

An increased number of people would be active on the landscape at the time of construction, increasing the likelihood that cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be expected from operation and maintenance of the straddle and off-take facility.

Indirect Effects

Operation of the straddle and off-take facility would create noise and could present a visual adverse effect in its rural location. The structure housing the facility could be an incompatible visual and architectural element with the nearby ARR station and roadhouse.

Cook Inlet Natural Gas Liquids Extraction Plant Facility

The NGLEP facility would require a 5.2 acre parcel at the terminus of the pipeline.

Construction

Direct Effects

No reported cultural resource sites would be located within 1 mile of the proposed construction footprint. Construction could affect undiscovered cultural resource sites in the facility footprint.

Indirect Effects

An increased number of people would be active on the landscape at the time of construction, increasing the likelihood that cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be expected from operation and maintenance of the facility.

Indirect Effects

No indirect effects would be expected from operation and maintenance of the facility.

Mainline Valves and Pig Launcher/Receivers

There would be up to 37 MLVs and 6 pig launcher and receiver stations along the pipeline, with collocation where feasible with other aboveground facilities along the route.

Construction

Direct Effects

Construction could affect undiscovered cultural resource sites in the footprint of the valves and receivers. Pig stations would be collocated with aboveground facilities where possible to reduce the number of areas where direct effects could occur.

Indirect Effects

An increased number of people would be active on the landscape at the time of construction, increasing the likelihood that cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be expected from operation and maintenance of the MLVs and pig launcher/receivers.

Indirect Effects

The appearance of the MLVs could be an incompatible visual and architectural element on the landscape. The range of this impact would be reduced in forested areas of the ROW and greatest on tundra landscapes. Collocation of pig stations with other aboveground facilities should reduce the overall effects, as contrasted to placing them separately.

Access Roads

Access roads include temporary snow and ice roads and both temporary and permanent gravel roads. Access roads would allow lowboy trailers with tracked construction vehicles and pipe, buses, sport utility vehicles, and pickups. For this analysis, the width of the access roads was assumed to be 100 feet. Only new access roads were included in the analysis.

Construction

Direct Effects

Construction activity could have an adverse effect on 11 reported cultural resources as well as previously undiscovered cultural resource sites, or potential cultural landscapes and TCPs in and adjacent to the proposed access roads. Of these 11 AHRS numbers, 6 are the Dalton Highway itself (BET-002000, CHN-00070, LIV-00501, SAG-00097, and XBP-00114), 1 is a railroad tunnel (Moody Tunnel, HEA-00076), one is a prehistoric archaeological site adjacent to the ARR (Nenana Gorge Site, HEA-00062), 1 is a historic trail (Dunbar Trail, LIV-00556 and FAI-02102), and 1 (LIV-00170), near the E.L. Patton Bridge across the Yukon River, has no information in the AHRS files. One RS 2477 trail, the Dunbar-Brooks Terminal segment of the Dunbar Trail (FAI-02102), is crossed by access roads.

Indirect Effects

Runoff, erosion, and redeposition of sediment due to road construction activities could expose, disturb, or bury evidence of cultural resources. Access to areas previously unsurveyed for cultural resources would be increased as personnel built the access roads, increasing the likelihood of inadvertent discovery and potential damage or looting.

Operations and Maintenance

Direct Effects

No direct effects are expected from operation and maintenance of the access roads.

Indirect Effects

Access roads, coupled with a cleared and maintained ROW, would create new networks of trails for summer and winter users. Access pattern changes could redistribute the use of existing trail networks such that cultural resources not previously accessible could be adversely affected. Potentially these new access roads could increase access to 145 AHRS sites and 7 RS 2477 trails.

Support Facilities

Operations and Maintenance Buildings

Construction

Direct Effects

Support facilities would occur within the footprint of the GCF at Prudhoe Bay, the straddle and off-take facility, and the Cook Inlet NGLEP Facility, and direct effects would be the same as described above.

Indirect Effects

Support facilities would occur within the footprint of the GCF at Prudhoe Bay, the straddle and off-take facility, and the Cook Inlet NGLEP Facility, and indirect effects would be the same as described above.

Operations and Maintenance

Direct Effects

Support facilities would occur within the footprint of the GCF at Prudhoe Bay, the straddle and off-take facility, and the Cook Inlet NGLEP Facility, and direct effects would be the same as described above.

Indirect Effects

Support facilities would occur within the footprint of the GCF at Prudhoe Bay, the straddle and off-take facility, and the Cook Inlet NGLEP Facility, and indirect effects would be the same as described above.

Construction Camps and Pipeline Yards

Construction

Direct Effects

Construction could affect undiscovered cultural resource sites in the footprint of the construction camps and pipeline yards.

Indirect Effects

An increased number of people would be active on the landscape near the construction camps and pipeline yards at the time of construction, increasing the likelihood that cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be anticipated, as the construction camps and pipeline yards would not be used during operations and maintenance.

Indirect Effects

No indirect effects would be anticipated, as the construction camps and pipeline yards would not be used during operations and maintenance.

Material Sites

An estimated 13,100,000 cubic yards of material may be required for proposed Project construction. The proposed Project expects that the use of 546 existing material sites would be sufficient to meet the proposed Project's needs. A majority of these sites would be located within 10 miles of the proposed Project.

Construction

Direct Effects

No direct effects would be expected from use of the material sites, because the proposed Project is proposing to use only existing material sites. If new material sites are proposed, construction could affect undiscovered cultural resource sites through site disturbance or removal.

Indirect Effects

An increased number of people would be active on the landscape near the material sites at the time of construction, increasing the likelihood that cultural resource sites would be visited, discovered, or damaged.

Operations and Maintenance

Direct Effects

No direct effects would be anticipated as the material sites would not be used during operations and maintenance.

Indirect Effects

No indirect effects would be anticipated as the material sites would not be used during operations and maintenance.

5.13.3.4 Denali National Park Route Variation

The Denali National Park Route Variation would be located along the Parks Highway east of the McKinley Village area. For the Denali National Park Route Variation segment, there are no reported sites that could potentially experience direct effects from the proposed Project construction and 12 sites that fall within the area for potential indirect effects (Table 5.13-14). No RS 2477 trails would be crossed by the proposed Project within this segment (Table 5.13-15). Two cabins, 6 ARR structures, and 2 grave AHRS sites constitute the built environment on this route segment-the graves may be associated with the ARR. The potential for unanticipated discovery of archaeological deposits would be lower for this alternative than for the corresponding MP 540 to MP 555 segment, as this alternative follows the Parks Highway, which has already been previously disturbed.

Construction

Direct Effects

Direct effects from construction of the Denali National Park Route Variation would be the same as those described above under "Mainline."

Indirect Effects

Indirect effects from construction of the Denali National Park Route Variation would be the same as those described above under "Mainline."

Operations and Maintenance

Direct Effects

Direct effects from operations and maintenance of the Denali National Park Route Variation would be the same as those described above under "Mainline."

Indirect Effects

Indirect effects from operations and maintenance of the Denali National Park Route Variation would be the same as those described above under "Mainline."

5.13.4 References

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